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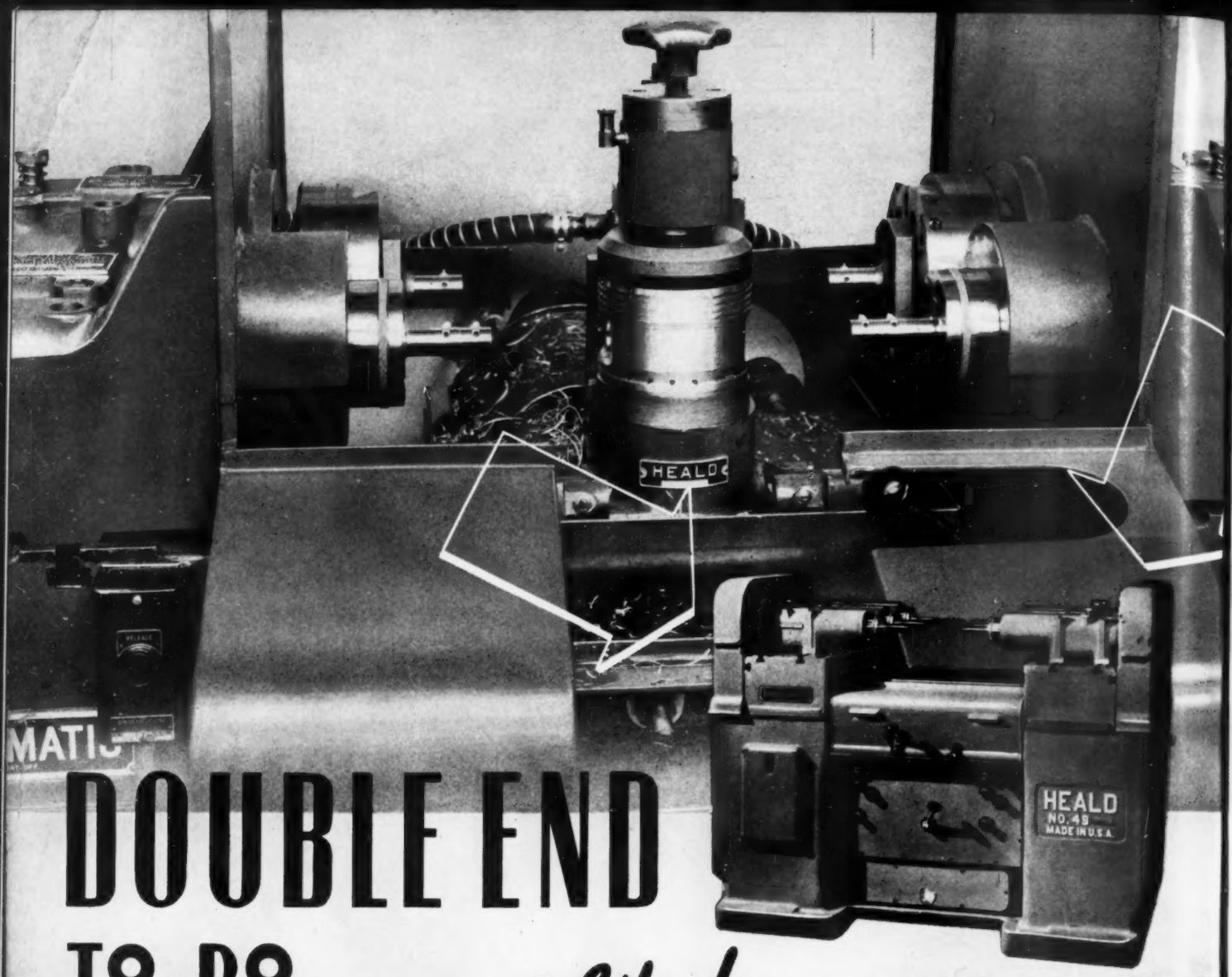

DOUBLE END

TO DO *Twice as Much Work*

Double end Bore-Matics are built in three different sizes — Styles No. 45B, No. 46B and No. 49B — which enables selection of the right machine for every double end boring job. Illustrated above is a double end No. 49 Bore-Matic which bores and counter-bores both piston pin holes with front opposed heads and grooves pin holes with heads at rear.

TWICE as much precision work per cycle . . . that's exactly what can be accomplished on Heald Double End Bore-Matics . . . because these machines are arranged to perform borizing operations AT TWO ENDS by means of opposed boring heads and table traverse in both directions. Briefly here's what you can do on Double End Bore-Matics . . . borize multiple parts in a single cycle . . . semi-finish and finish borize one or more parts in the same setting . . . borize surfaces dead in line in opposite ends of one or several parts . . . perform a series of progressive operations on the same part or several parts. Heald Bore-Matics are available, too, as single end machines for borizing from one end only. Altogether there are ten different styles of Heald Bore-Matics in both single end and double end types to exactly meet your requirements in precision finishing. Write, phone or wire us for complete details, today.

BORIZE FOR PRECISION

THE HEALD MACHINE CO. WORCESTER, MASS. U. S. A.

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AMERICAN MACHINIST

February 5, 1942

All Out—Automobile manufacturers turn 100 percent to armament as the industry ends peacetime production

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VOLUME 86 NUMBER 3

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Coming March 19

THE ANNUAL TOOL ENGINEERING NUMBER OF AMERICAN MACHINIST

To be published just a week preceding the annual convention of the American Society of Tool Engineers in St. Louis, March 26-28

Scheduled are these feature articles:

Cutting Oils — special "blue section", a condensed handbook on the subject.

Armament Section Number 39 — detailing production methods on a vital munitions item.

Standardizing Carbide-Tool Tips — by Frank Curtis, president of the A.S.T.E.

Abrasive Cut-off Practice — first of three articles.

Drawing Dies for Rectangular Shells.

The Role of Tool Engineering in the Victory Program.

Short Cuts for the Small Shop — another in this popular series.

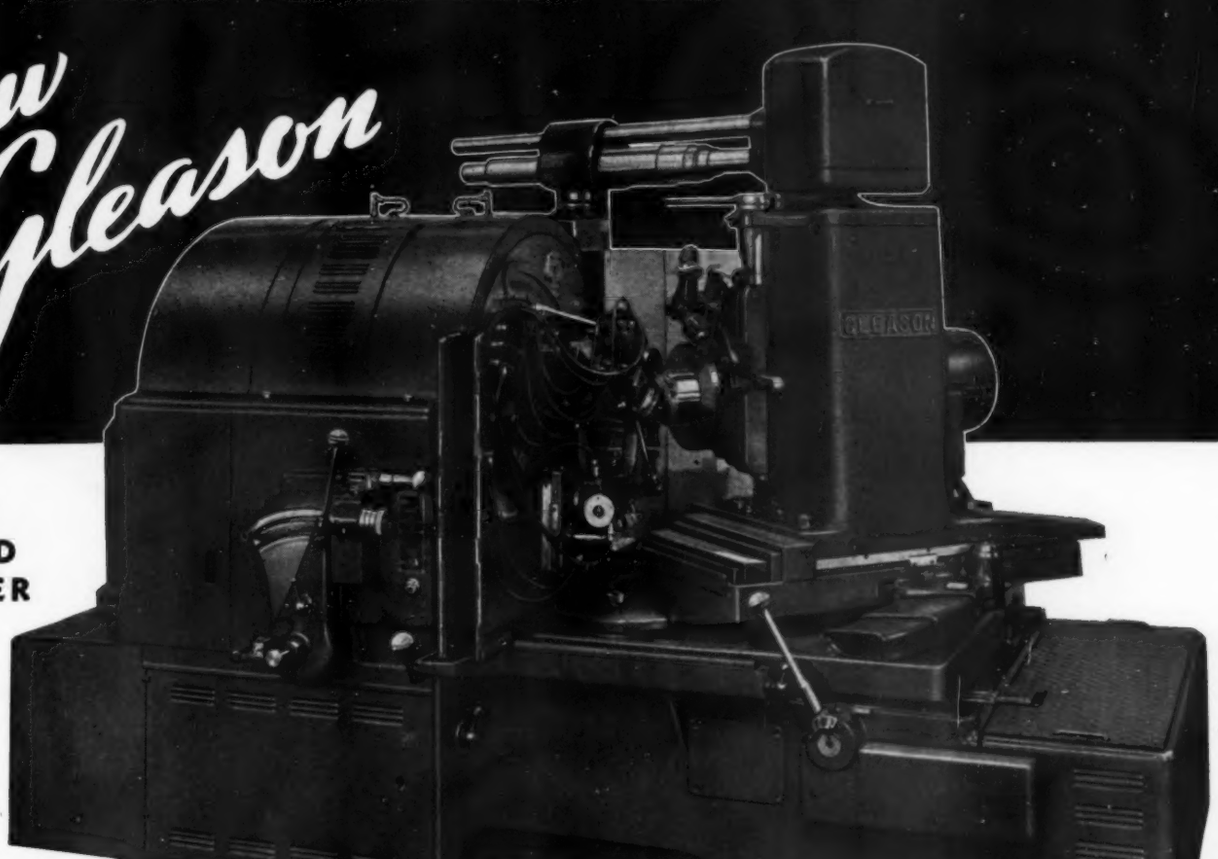
Design of Special Chucks — second of the series of sketch presentations.

Getting the Most from Carbides.

Watch for... and USE *... Your Copy!*

TEETH OF BEVEL AND HYPOID GEARS PRECISION GROUND ON THIS

New Gleason



No. 17 HYPOID GRINDER

FOR GENERATED GEARS AND PINIONS

With the new Gleason No. 17 Grinder, the teeth of hardened curved-tooth bevel and hypoid gears and pinions are now finished by precision grinding many times faster than possible by cutting.

Send prints for complete information on grinding your bevel gears.

ADVANTAGES OF GROUND BEVEL GEARS

Heat-treat distortion corrected . . . all teeth made uniform . . . surface irregularities eliminated . . . tool marks removed . . . tooth profile and fillet blended smoothly into bottom land . . . RESULT—SMOOTHER, QUIETER, LONGER-LIVED GEARS.

SPECIFICATIONS

Cone distance, maximum	12½"
Pitch, coarsest	2½ DP
Whole depth, maximum	¾"
Face width, maximum	2½"
Ratio, shafts at 90	1 to 1—4½ to 1
Wheel diameters	5¾" to 13½"
Feeds, time per pass per tooth	1.9 to 11.8 sec.
Floor space	65¾" x 111¾"

◀Ground Spiral Bevel Gears for Controllable Pitch Propeller Unit.

GLEASON WORKS

Builders of Bevel Gear Machinery for Over Seventy-five Years

1000 UNIVERSITY AVENUE, ROCHESTER, N. Y., U. S. A.

‡ 40 thread and feed changes—the customer was getting an outstandingly profitable tool.

† Belt driven step pulleys and loose transposing gears eliminated on Lodge & Shipley Lathes.

⁂ With 19 patented features, Lodge & Shipley Lathes were doing work of outstanding accuracy in 1892.

1901
‡1895-96
† 1894
⁂ 1892
THE LODGE & SHIPLEY RECORD
AMERICAN MACHINIST
STEEL GEARS
From October first, 1901, every gear with the exception of the spindle and back gears on every Lathe we manufacture, will be steel and machine cut. The tendency has been to demand more and more of Lathes. This we met at first by making all feeds by gears and now by using steel gears. The other parts of the Lathes are ample in proportion and proper in design to fully meet the new conditions . . . . . .
SIZES: 14 inches to 60 inches.
THE LODGE & SHIPLEY MACHINE TOOL COMPANY,
CINCINNATI, OHIO, U.S.A.

Read the facts brought out in the ad from American Machinist of 1901, for they indicate the advanced position of Lodge & Shipley Lathes forty-one years ago. They met the NEW demands of that day, just as they meet the NEW demands of the present.

and proper in design to

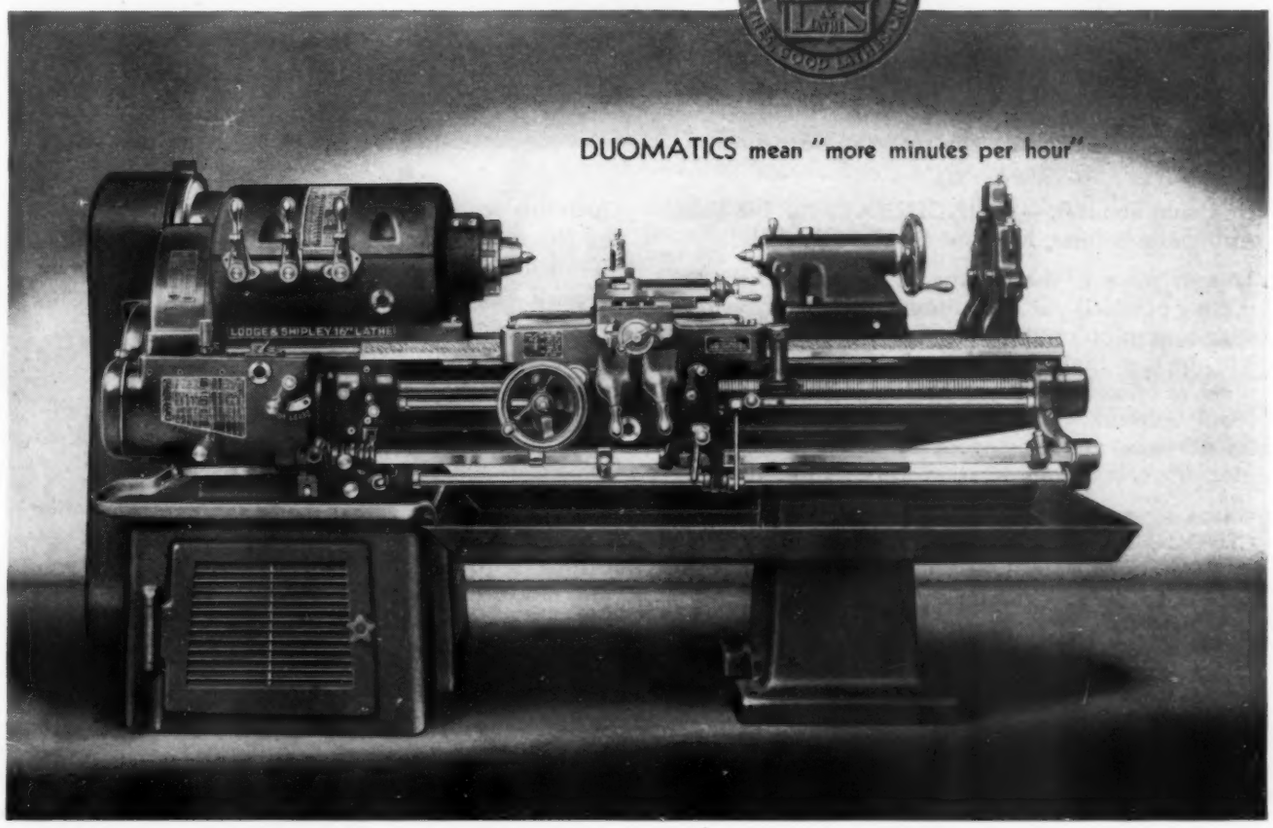
CUTTING the time per piece . . . cutting spoilage is the backbone of the terrific production needed today. Lodge & Shipley sound and experienced designing, careful manufacture, bring to your shops lathes on which you can safely depend. They are built to take the extra load.

THE LODGE & SHIPLEY MACHINE TOOL CO.

CINCINNATI, OHIO, U.S.A

Engine *Tool Room* *Automatic Lathes*

since 1892



No doubt about it — a CINCINNATI No. 0-8 Plain Automatic Milling Machine SAVES TIME!

If your place in the scheme of things calls for the milling of small parts, you must do everything possible to step up production. And we know a No. 0-8 will do just that. Performance records on a wide range of operations show that CINCINNATI No. 0-8 Plain Automatic Milling Machines are SAVING TIME — in some instances as much as 50% — a most important consideration in times like these.

There are several reasons why you should select a CINCINNATI No. 0-8. First: It helps solve the problem of securing skilled help. You don't have to depend on the operator for accuracy or skill because the machine is completely automatic. Second: Operators are able to work with less fatigue because the No. 0-8 is easy to operate and care for. Third: The machine is capable of handling a wide range of work. By simply changing from one operating cycle to another, a matter of a minute or two, a large number of useful operating cycles are made available. Fourth: The CINCINNATI No. 0-8 with Rise and Fall Spindle Carrier is especially desirable on jobs where it is not possible for the work to traverse directly into the cut.

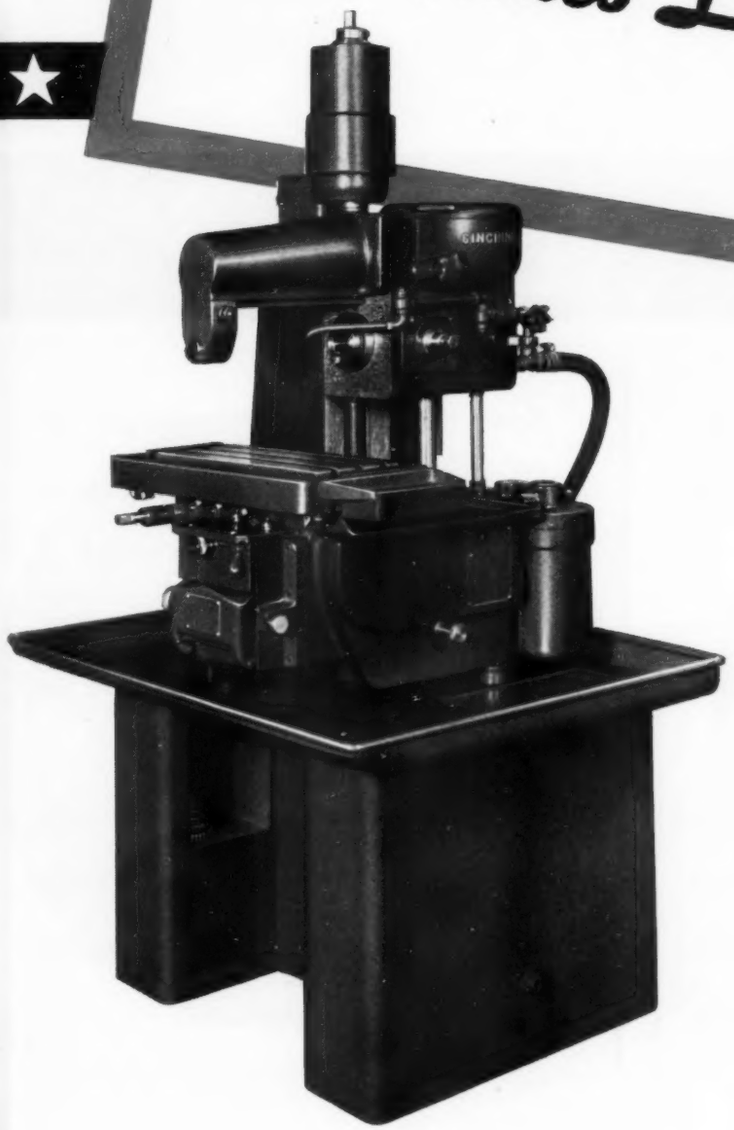
For these and many other reasons, it will be to your advantage to consider CINCINNATI No. 0-8 Plain Automatic Milling Machines for the fast and accurate production of your small parts. Investigate now! Send for specification catalog M-964 today.

THE CINCINNATI MILLING MACHINE CO.

Cincinnati, Ohio U. S. A.

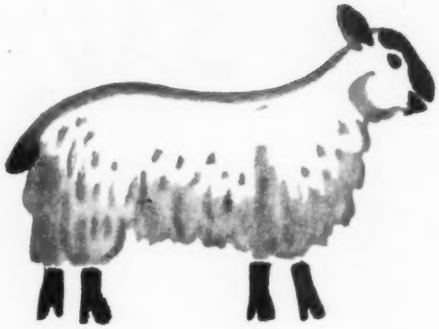
TOOL ROOM AND MANUFACTURING MILLING MACHINES
SURFACE BROACHING MACHINES • CUTTER SHARPENING MACHINES

"SAVE with a Cincinnati!" MEANS EVEN MORE in Times Like These



Illustrated at left is a CINCINNATI No. 0-8 Plain Automatic Milling Machine with Rise and Fall Spindle Carrier. Specification catalog M-964 covers complete information on all features and their benefits. A copy is yours for the asking.

CINCINNATI



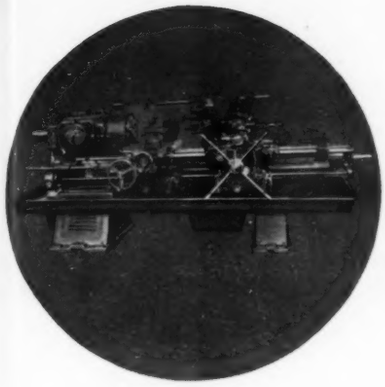
Whether it's wool or mutton you want

Rare, indeed, is the chance to go after the big horn sheep on his range high in the Rockies. But whether it's wool or mutton you want, domestic flocks in the valleys supply the needs of man — year in, year out.

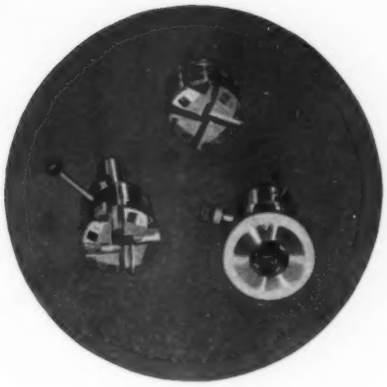
Likewise, year in, year out, versatile, high speed, modern Jones & Lamson equipment can rush wartime production or work for peace-time prosperity.

Special equipment designed for rare emergencies can only be scrapped when the crisis is over, while standard long-lived Jones & Lamson Machines will still be ready to help you face the keen competition of a postwar world.

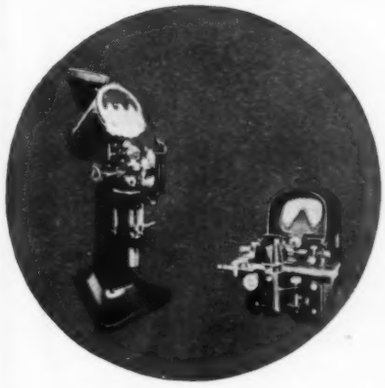
That's why prudent management relies on Jones & Lamson engineers to meet today's demands and provide protection for future profits.



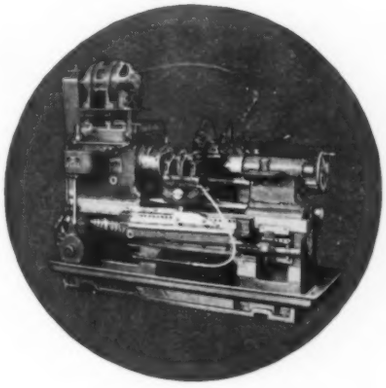
Ram & Saddle Type Universal Turret Lathes



Automatic Opening Die Heads



Optical Comparators



Fay Automatic Lathes

JONES & LAMSON MACHINE COMPANY

PROFIT PRODUCING MACHINE TOOLS

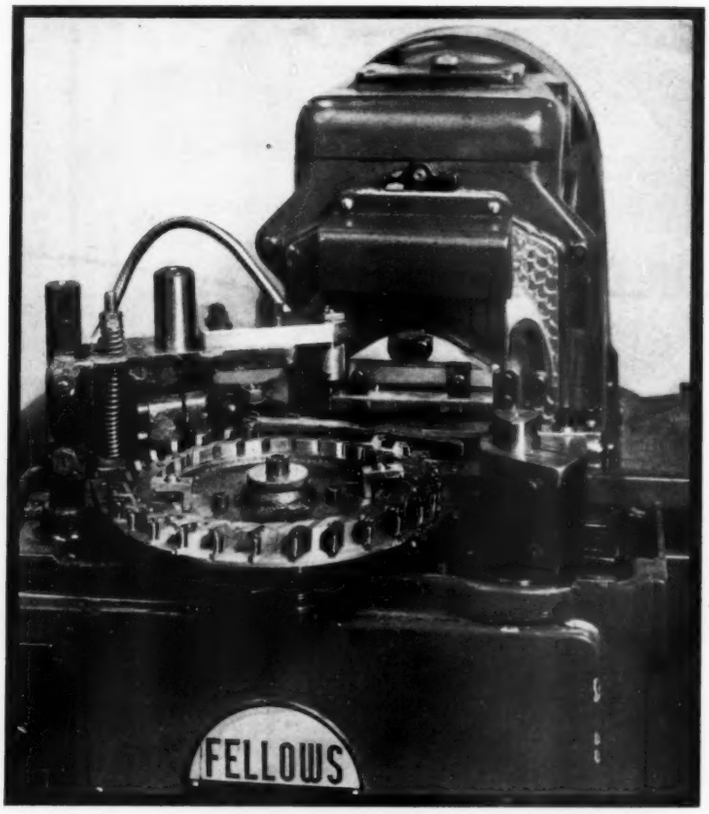
SPRINGFIELD, VERMONT, U. S. A.

Jones & Lamson Automatic Thread Grinder— Model TG-615

Jones & Lamson Automatic Thread Grinder— Model TG-1245

MANUFACTURERS OF: RAM & SADDLE TYPE UNIVERSAL TURRET LATHES . . . FAY AUTOMATIC LATHES . . . AUTOMATIC THREAD GRINDING MACHINES . . . COMPARATORS . . . AUTOMATIC OPENING THREADING DIES AND CHASERS.

Straight Line HIGH



ABOVE: A magazine-feed set-up on the Fellows Straight-Line Gear Generator. Maximum diameter capacities: 1-½ inches pitch diameter spur, and 1-inch on helical gears. On small thin blanks, output exceeds even that of sub-press dies—with precision of form and sustained accuracy beyond comparison.

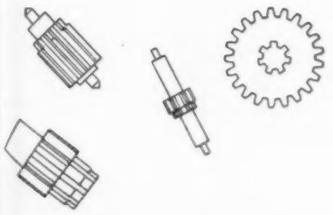
AT THE LEFT: Front view of the Straight-Line Gear Generator. Note, push-button control—foot-lever clamping and hand lever ejection, which is used when production is not sufficiently great to necessitate magazine handling.

FELLOWS

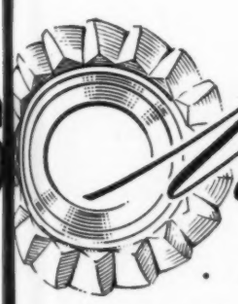
MACHINES AND TOOLS FOR GEAR PRODUCTIO

PRODUCTION

ON SMALL GEARS



STRAIGHT LINE . . . has a dual implication on this machine in that it represents a new method of gear cutting, and a more direct means to higher production. The "straight line" rack-type cutter used has several advantages, particularly for the cutting of fine-pitch gears. It can be easily made to "top" the teeth—finish the blank to the correct outside diameter; and is especially adapted to the cutting of non-involute shapes. Furthermore, the rack type cutter, when used particularly for cutting small gears and pinions, can be made with multiple groups of teeth separated by gaps. These gaps enable the work to be loaded from a magazine and ejected automatically without stopping the machine. For more detailed information ask for a copy of new illustrated circular. Write: The Fellows Gear Shaper Company, Springfield, Vermont—or 616 Fisher Building, Detroit, or 640 West Town Office Building, Chicago.



Method

. . . . FROM BLANK TO FINISHED GEAR

YOU'LL HAVE NO

with this machine

The virtual elimination of maintenance in CINCINNATI Hydraulic Universal Grinding Machines should make them a logical choice for your toolroom grinding and general manufacturing work. We know they will stay on the job and give you practically continuous, trouble-free operation . . . just the sort of performance you'd expect from the finest grinding machine manufactured. Here are a few of the reasons why maintenance is so negligible:

1. **FILMATIC** Spindle Bearings give a more rigid and accurate support to the spindle at all times. There's no seizure, no breakdown, and spindle flutter, a common source of chatter, has been completely eliminated.
2. **TABLEWAYS** are pressure lubricated with filtered oil from a circulating system, and completely covered with telescoping guards to prevent entrance of coolant and grit.
3. Every Power Operated Mechanism is either pressure lubricated or completely submerged in oil. Saves wear, preserves accuracy.
4. **BUILT-IN JACKS** encourage a periodic check of machine levelness, especially desirable when placing machines in new buildings.
5. The **MEEHANITE BED** is sufficiently massive to absorb vibration and resist warpage to an unusual degree, even when subject to widely varying temperatures.

Now that speed is all important, CINCINNATI Hydraulic Universals are especially desirable because one machine will actually do the work of two of an older type and do it more accurately with less operator effort. These machines are so accurate a .0001" limit is practical. They assure Faster Set-Up, Faster Handling, Faster Grinding and Faster Sizing — four very important considerations in times like these.

You'll be interested in all the details of these fine, precision grinding machines. Specification catalogs G-486 and G-474 give complete information on all features and their benefits. Copies will be sent on request. Write today.

MAINTENANCE WORRIES

CINCINNATI Hydraulic Universal Grinding Machines are available in 12", 14", 16" and 18" swings; between-center distances up to 72".

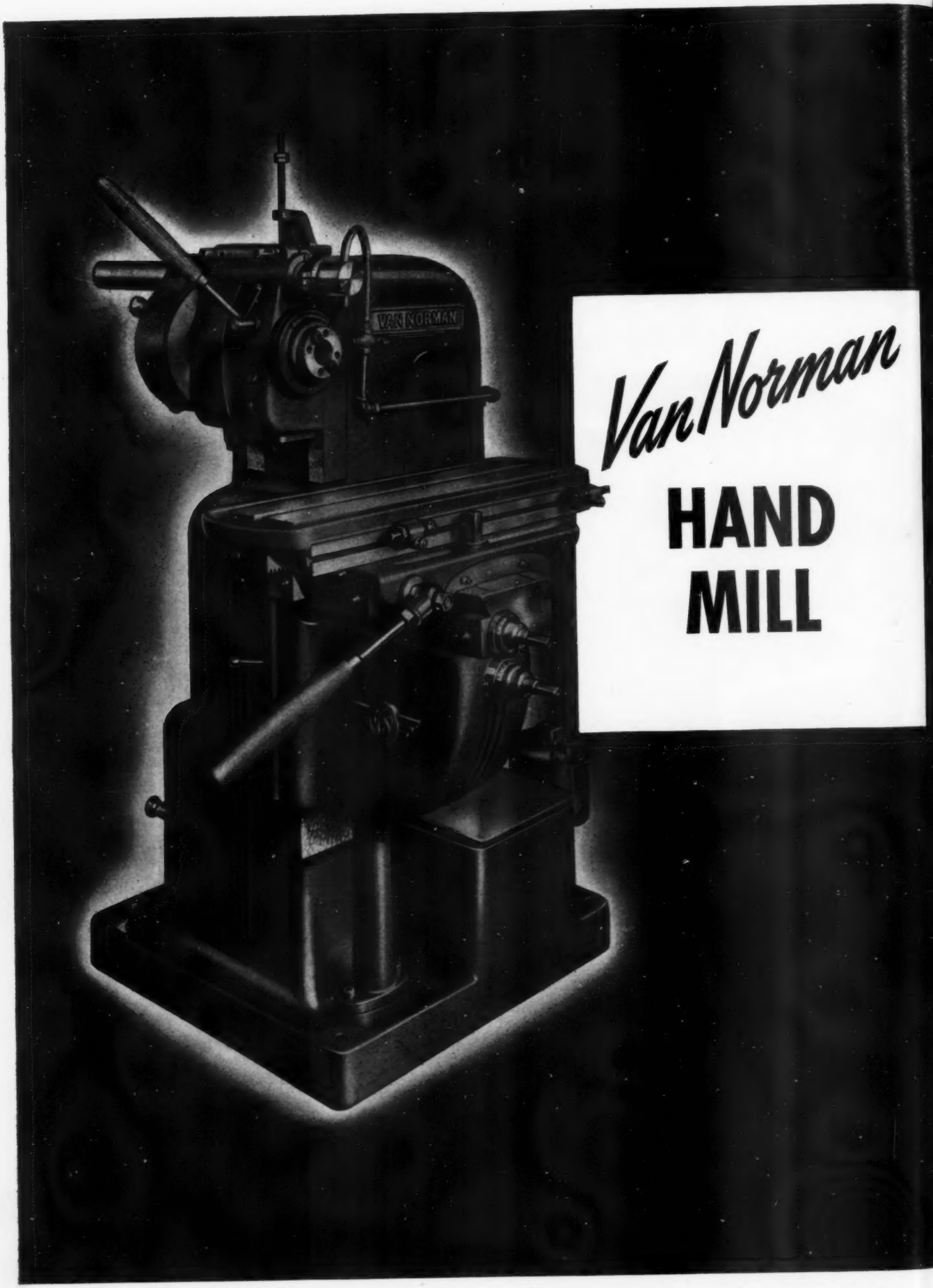
SAVE *with a Cincinnati!*

CINCINNATI

CINCINNATI GRINDERS INCORPORATED

Cincinnati, Ohio U. S. A.

CENTER TYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES
CENTERLESS LAPPING MACHINES


VAN NORMAN
Van Norman
HAND
MILL

...adds new utility to any Production Department

This modern machine is an invaluable "general utility" member of the milling lineup in any production department... bringing new speed, accuracy and economy to the output of many small and medium-sized parts.

The Hand Mill is built to the highest standards of precision, with plenty of rigidity and power for maximum metal-removing capacity, and smooth operation. The heavy-duty cutter-spindle, mounted in the movable cutterhead, is driven by a 1½ HP motor. This machine has the rugged strength for heavy cuts... and at the same time, has the sensitivity for smaller, lighter cuts. Every feature of the Van Norman Hand Mill is designed to assure the same high standards of performance which have been the distinguishing mark of all Van Norman Milling Machines for more than half a century. Write for bulletin.

SPECIFICATIONS:

Table: 26" x 6"
Table Longitudinal Adjustment: 17½"
Table Cross Adjustment: 7½"
Table Vertical Adjustment: 12½"
Cutterhead Vertical Movement: 6"
6 Spindle Speeds: 160 to 1100 rpm
1½ HP Motor Drive

VAN NORMAN MACHINE TOOL COMPANY • SPRINGFIELD, MASSACHUSETTS

27 SPINDLE SPEEDS *with only* 2 *control lever*

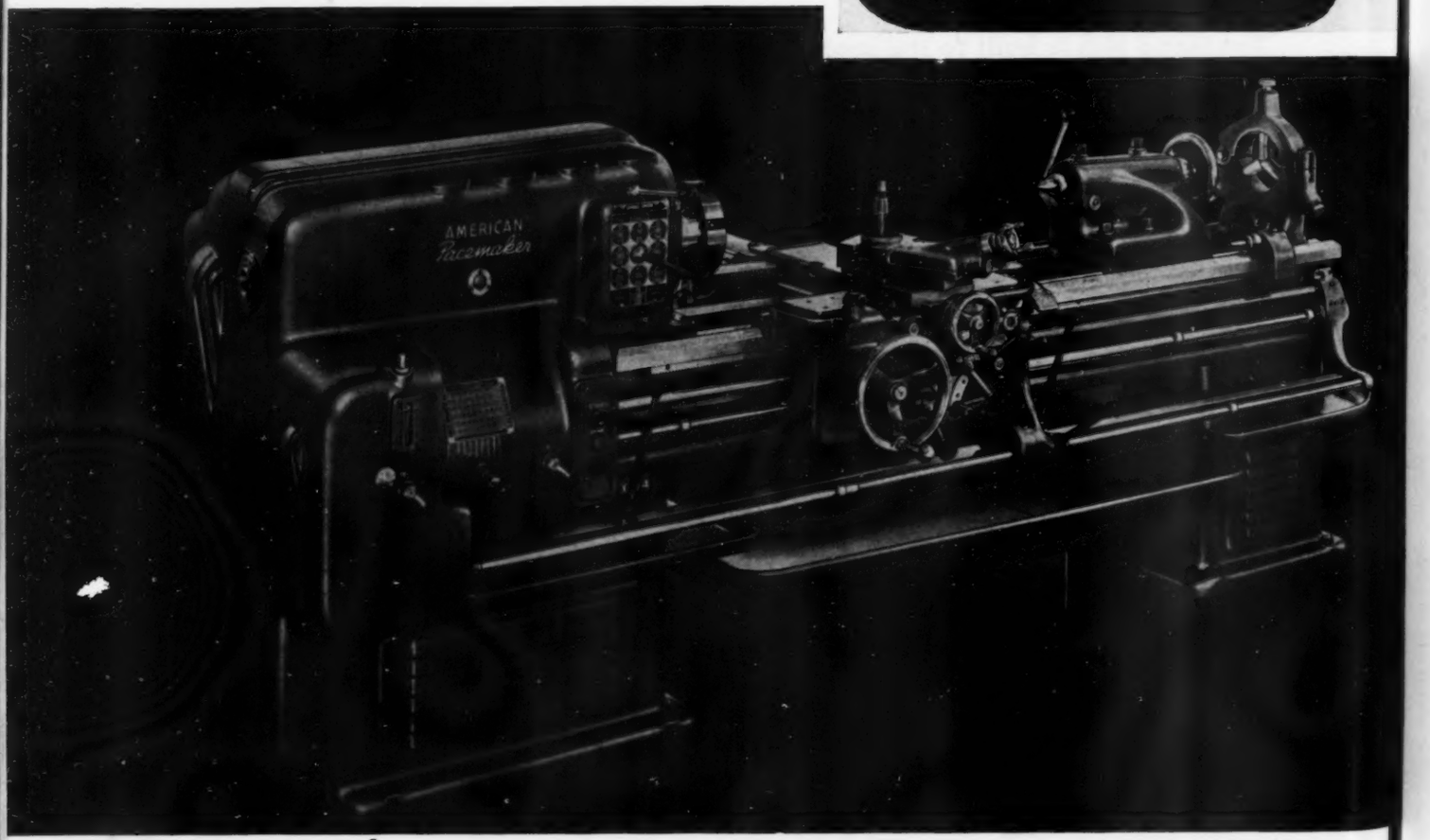
Convenience of control and ease of operation are two of the outstanding characteristics of the new "American" Pacemaker Lathes.

•

Imagine being able to secure any one of 27 spindle speeds thru only 2 conveniently placed direct reading levers without having to refer to index plates or having to retain lever positions in one's mind. Operators are enthusiastic in their praise of this new speed control. It makes their work easier; they produce work because of it and the pay roll dollar buys more as a consequence.

•

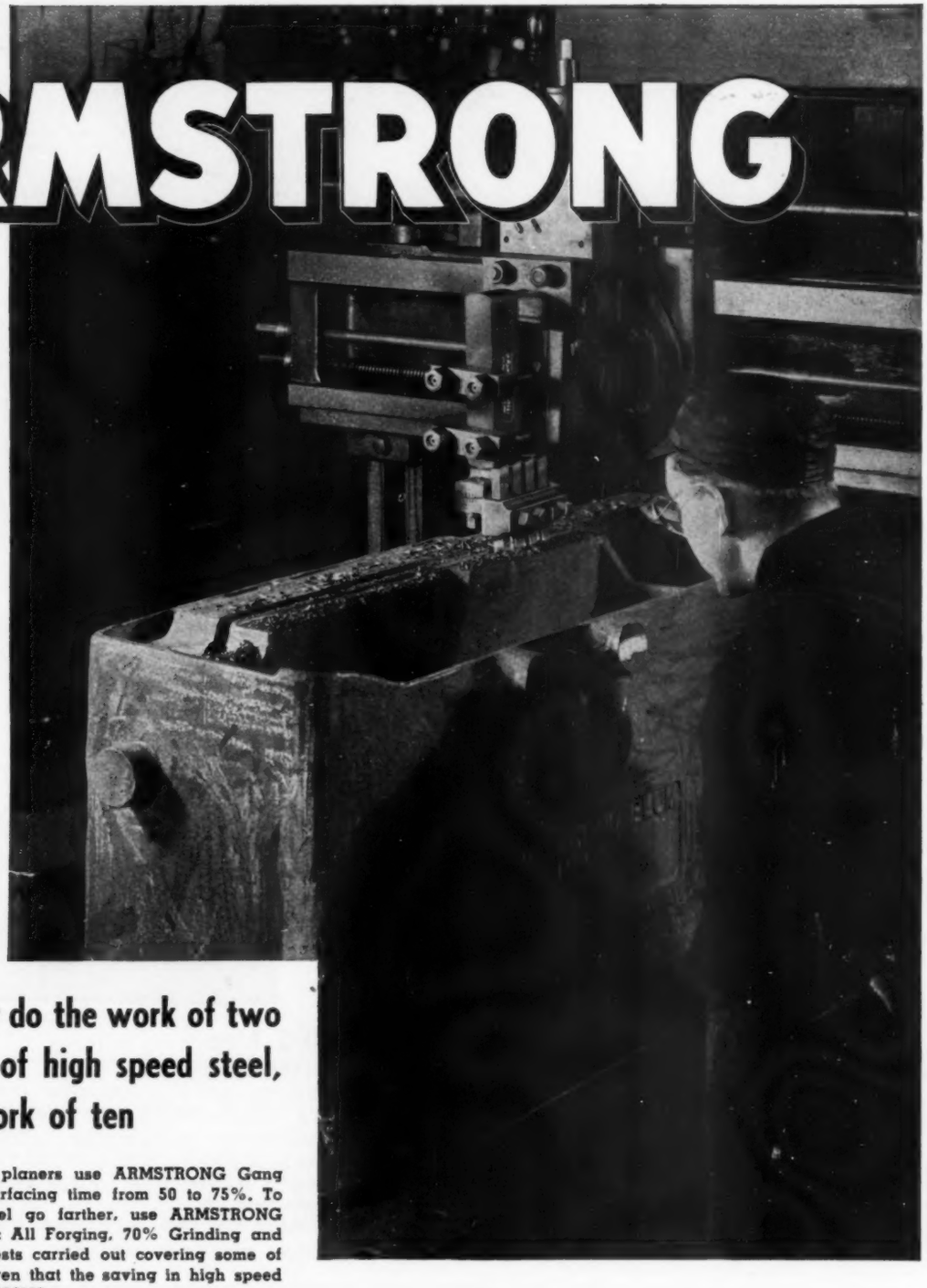
This and other fine features of the "American" Pacemaker are thoroughly covered by Bulletin No. 15.



LATHES • RADIALS • SHAPERS

THE AMERICAN TOOL WORKS CO., *Cincinnati,* **OHI**

ARMSTRONG



Make each planer do the work of two . . . each ounce of high speed steel, the work of ten

To double your output on planers use ARMSTRONG Gang Planer Tools that reduce surfacing time from 50 to 75%. To make your high speed steel go farther, use ARMSTRONG TOOL HOLDERS that "Save: All Forging, 70% Grinding and *90% High Speed Steel.*" (Tests carried out covering some of the largest plants have proven that the saving in high speed steel is even in excess of "90%").

There are ARMSTRONG TOOL HOLDERS for every operation on lathes, planers slotters and shapers, and, for many operations on turret lathes and screw machines. Each is a permanent multi-purpose tool that does the work of a complete set of forged tools. Each is a stronger more efficient tool than can be forged and will stand up to the highest speeds and heaviest feeds. Each makes an ounce of high speed steel go as far as 10 ounces will go in a forged tool.

Use ARMSTRONG TOOL HOLDERS wherever possible. On all types of work, the heaviest as well as the lightest, they save man-hours, increase machine tool output and cut high speed steel requirements to a tenth.

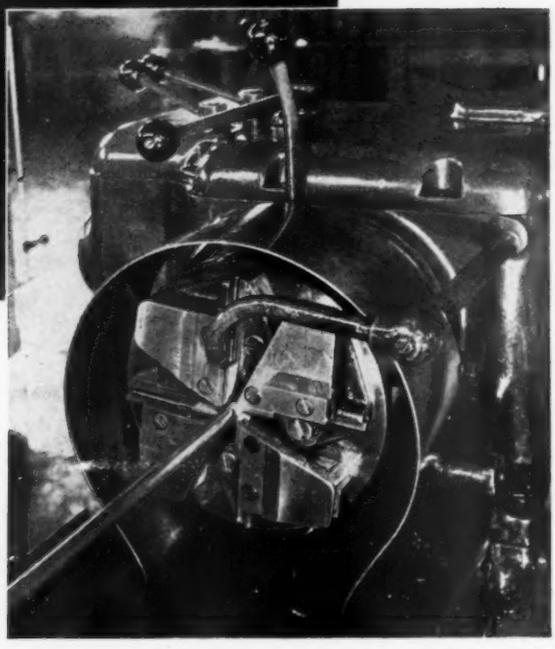
ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

315 N. FRANCISCO AVE. CHICAGO, U. S. A.

Eastern Warehouse & Sales Office:
199 Lafayette St., New York

ARMSTRONG TOOL HOLDERS Are Used in Over 96% of the Machine Shops and Tool Rooms

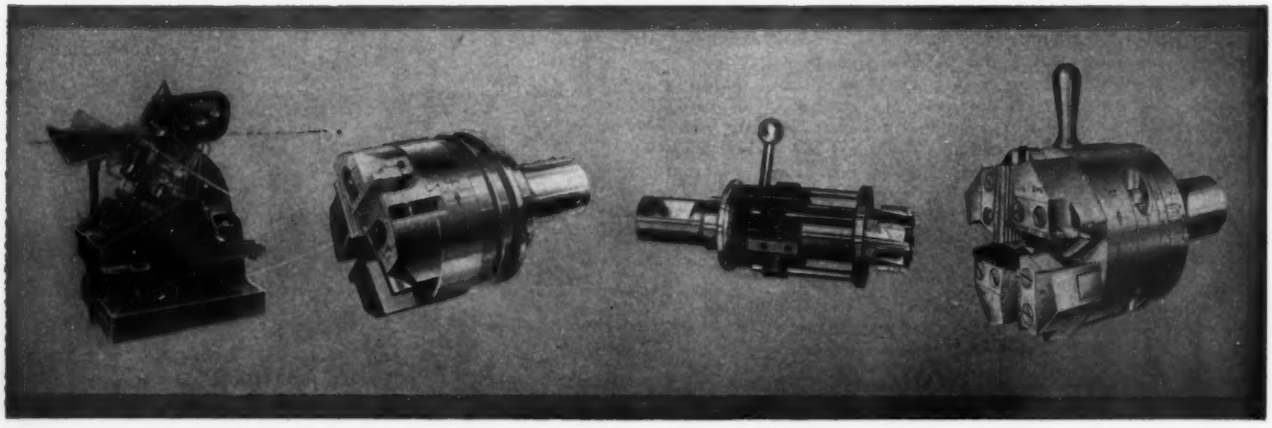


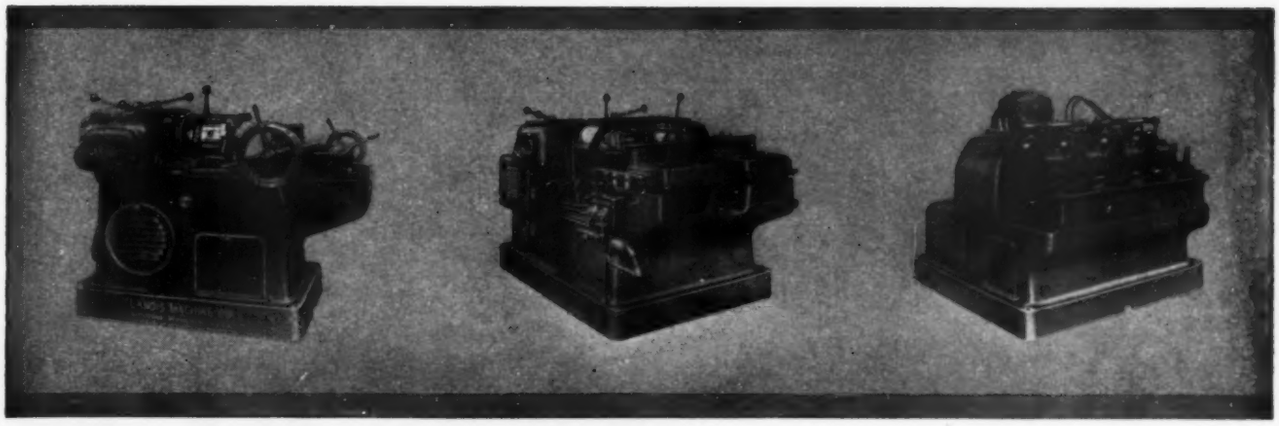
LANDIS
REG U.S. TRADE—MARK PAT. OFF.

The LANDIS *Line*

STANDARD THREADING MACHINES
LANDMACO THREADING MACHINES
BOLT FACTORY THREADERS
AUTOMATIC FORMING AND THREADING MACHINES
PIPE THREADING AND CUTTING MACHINES
PIPE AND NIPPLE THREADING MACHINES
ROLLER PIPE CUTTERS
CHASER GRINDERS
ROTARY BOLT THREADING DIE HEADS
STATIONARY PIPE DIE HEADS
LANDMATIC HEADS FOR TURRET LATHES
LANDEX HEADS FOR AUTOMATIC SCREW MACHINES
LANCO HEADS FOR HAND-OPERATED THREADING MACHINES
LANDIS COLLAPSIBLE AND ADJUSTABLE TAPS

—and the LANDIS PRECISION THREAD GRINDER





The precisely built

LANDMACO

—assures increased profits

A west coast manufacturer uses the LANDMACO Threading Machine for cutting continuous thread studs from 4140 annealed, alloy steel of 291 Brinell • • •

• • • The studs are threaded in 12′ bar lengths. The threads—$\frac{3}{4}$″ diameter, 10 pitch N. C.—have a permissible tolerance of .0025″ on pitch diameter.

By using the LANDMACO, operating cost is reduced 20% — the number of bars threaded, per grind of the chasers, increased 30% over previous methods.

These improved performance standards assure increased profits.

Investigate the advantages of using the LANDMACO Threading Machine for your Defense Threading Operations.

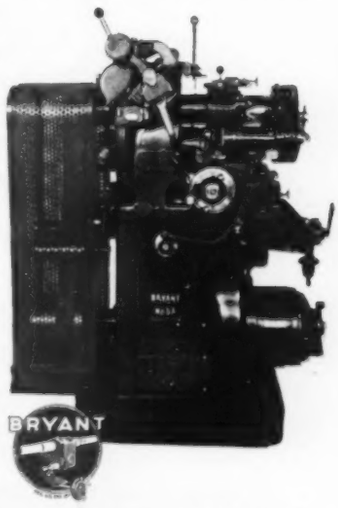
LANDIS

MACHINE COMPANY, Waynesboro Pennsylvania

A place at the

table for Bryant

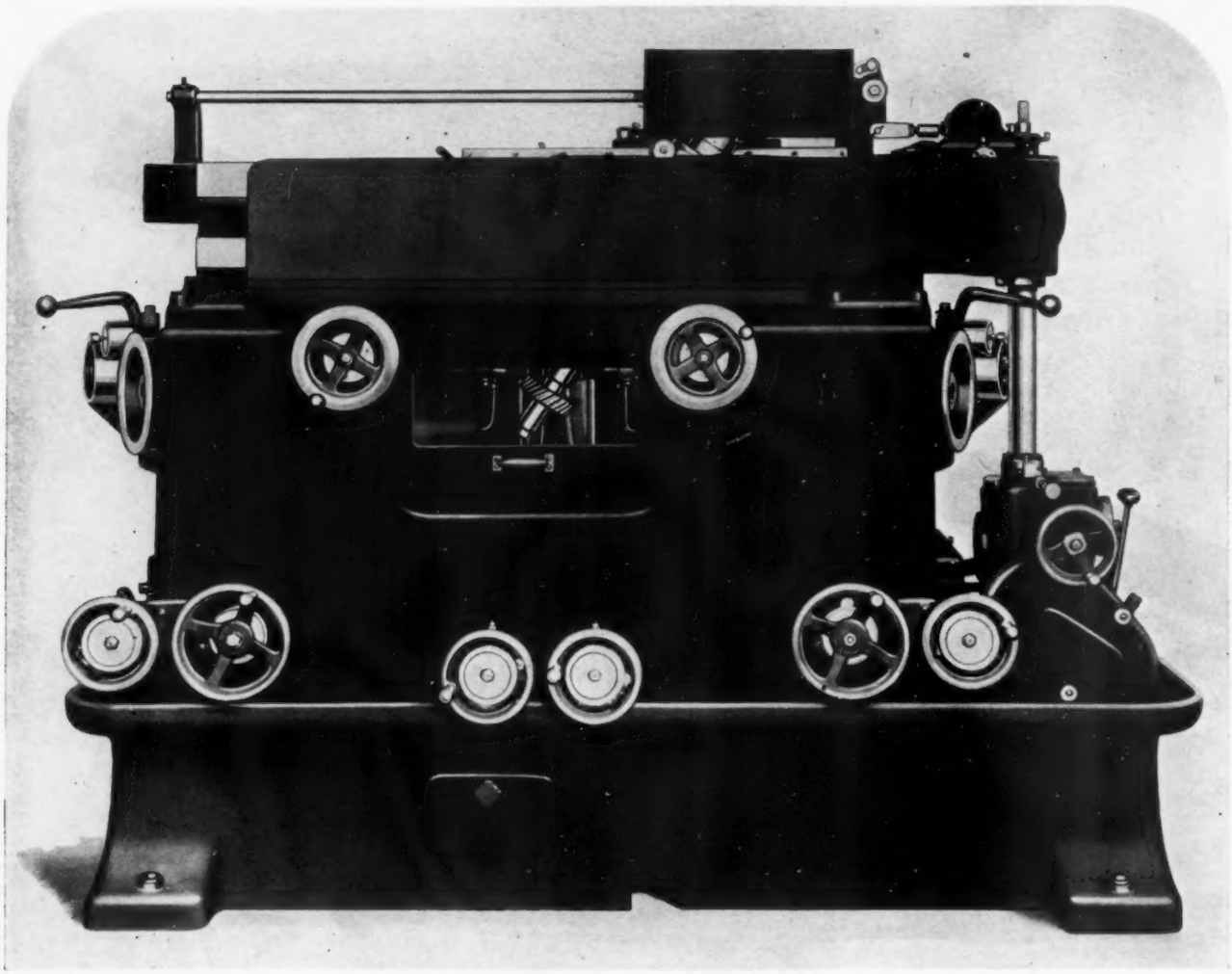
When questions come up on new products, with internal dimensions to grind, save a place at the table for Bryant. Bryant engineers can often point the way to unexpected profits by starting to work with you at this stage. Are you looking for new ways to cut costs and speed defense? Bryant's capacity, already tripled, is constantly increasing to help you.



Are you also concerned for the future? Side by side with armament are you studying post war markets and planning new products to sell them? The specialized experience of Bryant grinding engineers is available without obligation to help you. That's why far-sighted management knows it is worth while to make "a place at the table for Bryant."

BRYANT CHUCKING GRINDER CO.

SPRINGFIELD, VERMONT, U. S. A.



THE LEES-BRADNER 2HS GEAR GRINDER

GEARS

Accurately Ground···FAST···

Accurately ground gears in unprecedented quantities are essential to the continued progress in mechanizing our armed forces on land—on sea and in the air.

The Lees-Bradner Model 2HS machine for grinding gear teeth is unequalled for the rapid generation of ground gears to the most exacting dimensions.

The LEES-BRADNER Company

CLEVELAND, OHIO, U.S.A.

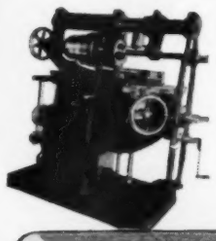
Helped to Make "THE GAY NINETIES" GAY!

1888

Frank Kempsmith, Founder, invented and produced the first KEMPSMITH MILLING MACHINE, destined to world-wide fame.

Industrial history marks "The Gay Nineties" as the beginning of the "Machine Age"... made possible by the perfection of machine tools which PRECEDED and created the foundation for the prosperity of the '90's. Then, as now, KEMPSMITH was an outstanding factor in American machine tool supremacy... and now KEMPSMITH is preparing, looking forward to new service to industry in the reconstruction days ahead!

1894



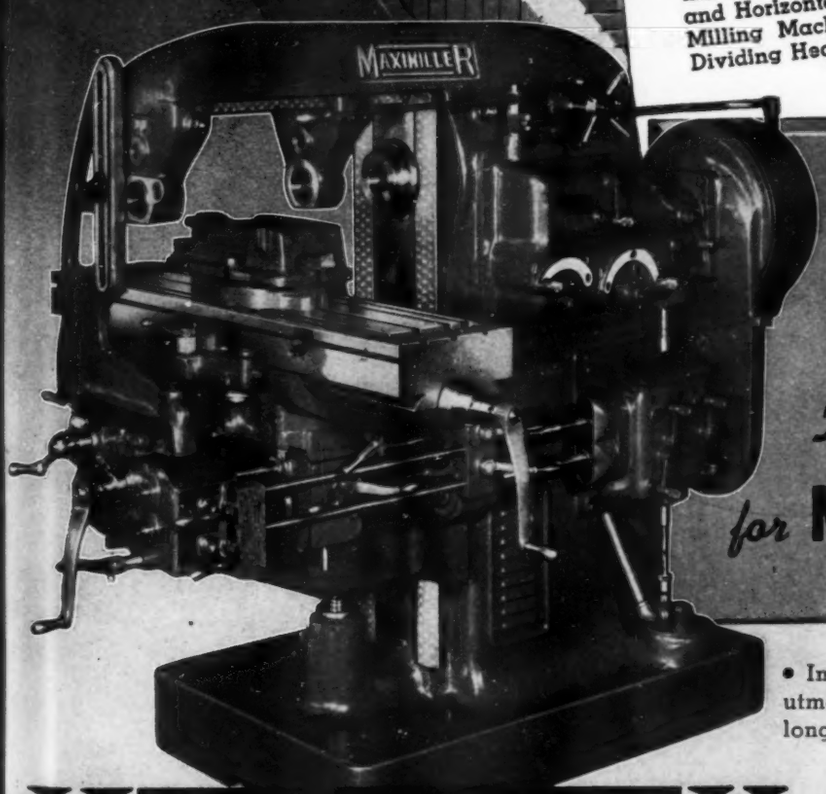
A big step forward in strength of drive and rigidity of support.

1942

KEMPSMITH PRECISION

Today and "Tomorrow"

Naturally, in these strenuous war days, KEMPSMITH experience is in demand on a 3-shift production basis. But research and designing for the future are also going forward... and the modern, flexible KEMPSMITH plant will be prepared to aid you in the post-war reconstruction period, with special or "production type" machine tools. Rugged KEMPSMITH MAXIMILLERS, Vertical and Horizontal (Plain or Universal) types; Type G Geared-Head Milling Machines for Tool Room or lighter production work; Dividing Heads; Heavy-Duty Vertical Attachments; High Speed Universal Attachments; Slotting Attachments; Vises; Arbors; Rotary Tables, Etc.



KEMPSMITH

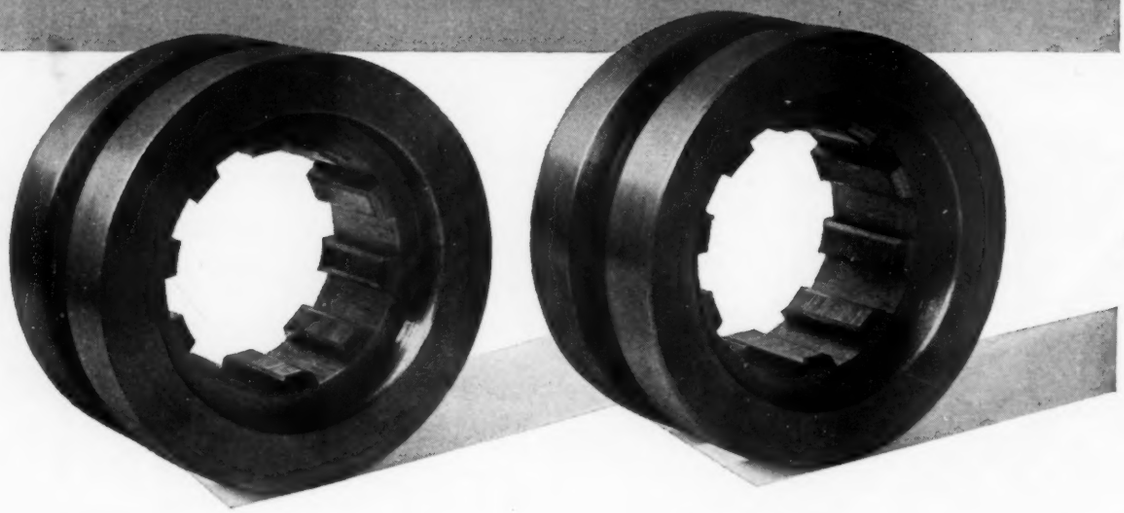
... for 54 Years Industry's By-word for **MILLING MACHINES**

• In KEMPSMITH MAXIMILLERS you are assured of utmost precision and extra power for continuous cuts on long production runs, in Horizontal (Plain or Universal) and Vertical Types.

KEMPSMITH MAXIMILLER

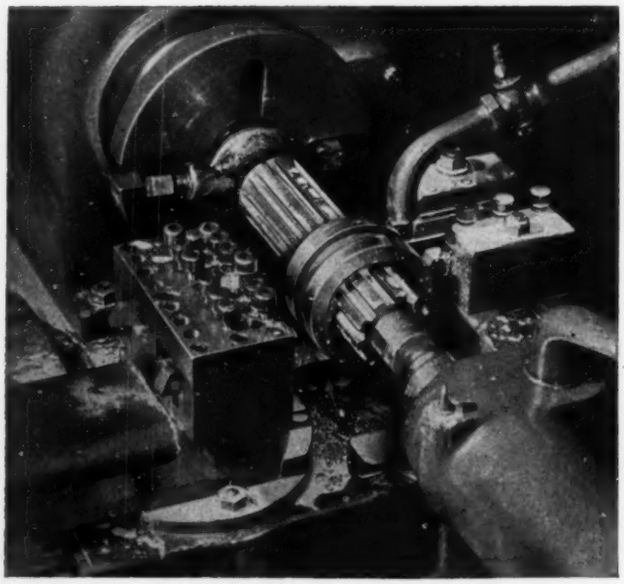
KEMPSMITH MACHINE COMPANY · MILWAUKEE, WISCONSIN · U. S. A.

USE *Ingenuity* TO GET



Illustrated above is a heavy double jawed clutch, before and after being finished on a Monarch lathe, prior to cutting jaws and heat-treating. The operation consists of turning outside diameter, forming groove, straddle facing sides, necking groove diameter and chamfering 4 outside corners.

This job is representative of the thousands of simple parts being machined in large and small lots, where ingenuity in planning will save time and release men and machines for other work. In this plant, it is being done with a single setup on a Monarch 18″ Model BB lathe, with double connected rest, tool block in front, and multiple tool block in rear.



How this job is done

1. Press piece on spline arbor and place between centers in lathe.
2. Turn diameter, using tool held in rear tool rest.
3. Form groove, allowing for grind. This tool is held in the rear rest.
4. Straddle face sides, and chamfer, tools being held in front tool rest.
5. Neck diameter and sides of groove for grind relief.
6. Remove from machine and press off arbor.

Material—SAE-2350 steel. Tools—cemented carbide. Total time—8 minutes.

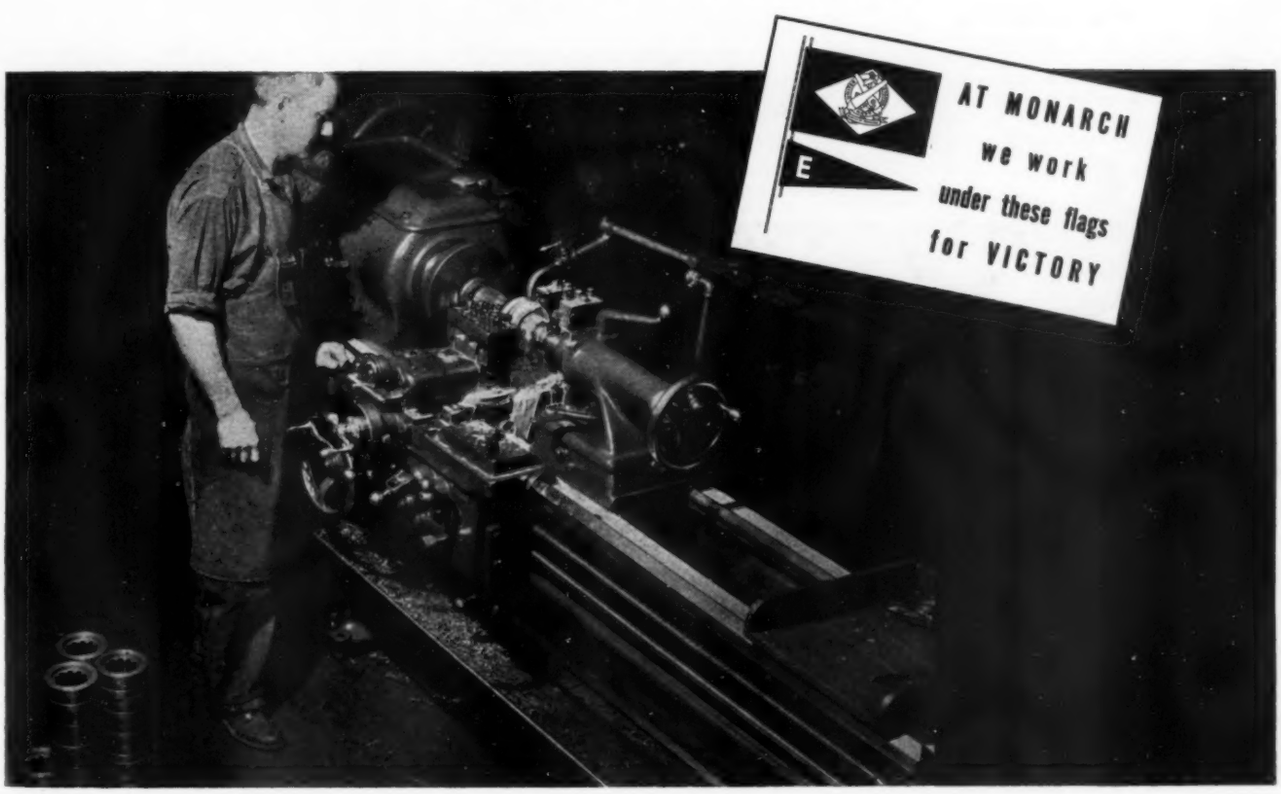
MORE WORK FROM MACHINE TOOLS

By using this method, one lathe and operator do the work with a single setup, instead of three separate setups, thus permitting more production from a single lathe.

This illustrates the ability of Monarch lathes to do a wide variety of work, valuable under our present production program. Their design and construction assure accurate performance, high productivity and long life. This is why Monarch lathes carry today's loads without faltering or lost time for maintenance and repairs. THE MONARCH MACHINE TOOL COMPANY, SIDNEY, OHIO.

MONARCH LATHES

COVER THE TURNING FIELD



SIMMONS
6" Bar Horizontal Boring and Facing Machine

Ready for March Delivery!

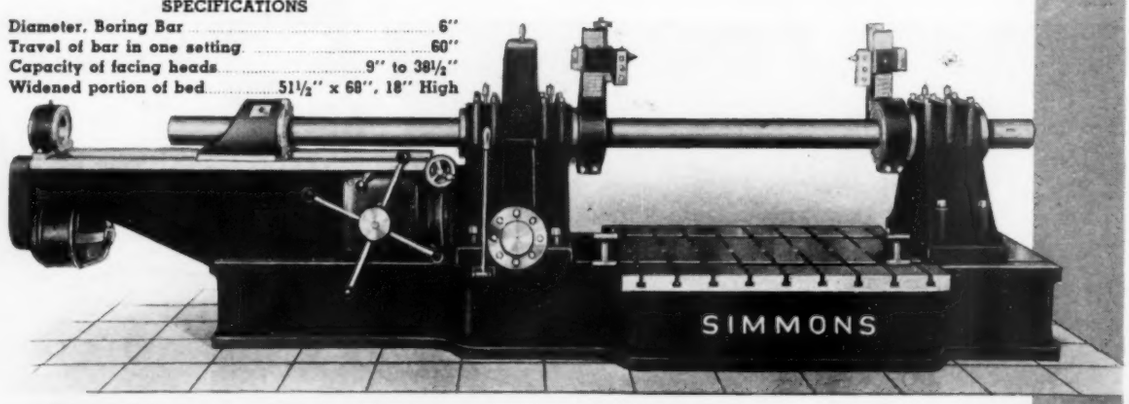
This new Simmons 6" Bar Horizontal Cylinder Boring and Facing Machine is the ideal machine for current War Production requirements. The bed is of massive construction and heavily ribbed to insure maintained alignment.

Equipped with Simmons Micro-Feed Unit, an infinitely variable transmission, this boring machine offers both fine and coarse feeds ranging from .004" to 1.000" per revolution of spindle. The main drive to the boring bar is obtained through a six-speed gear box, motor-driven. Gears are of high-carbon steel and mounted on spline shafts with anti-friction bearings running in oil. Power Rapid Traverse to bar in both directions.

DELIVERIES STARTING IN MARCH. Write TODAY for Descriptive Bulletin.

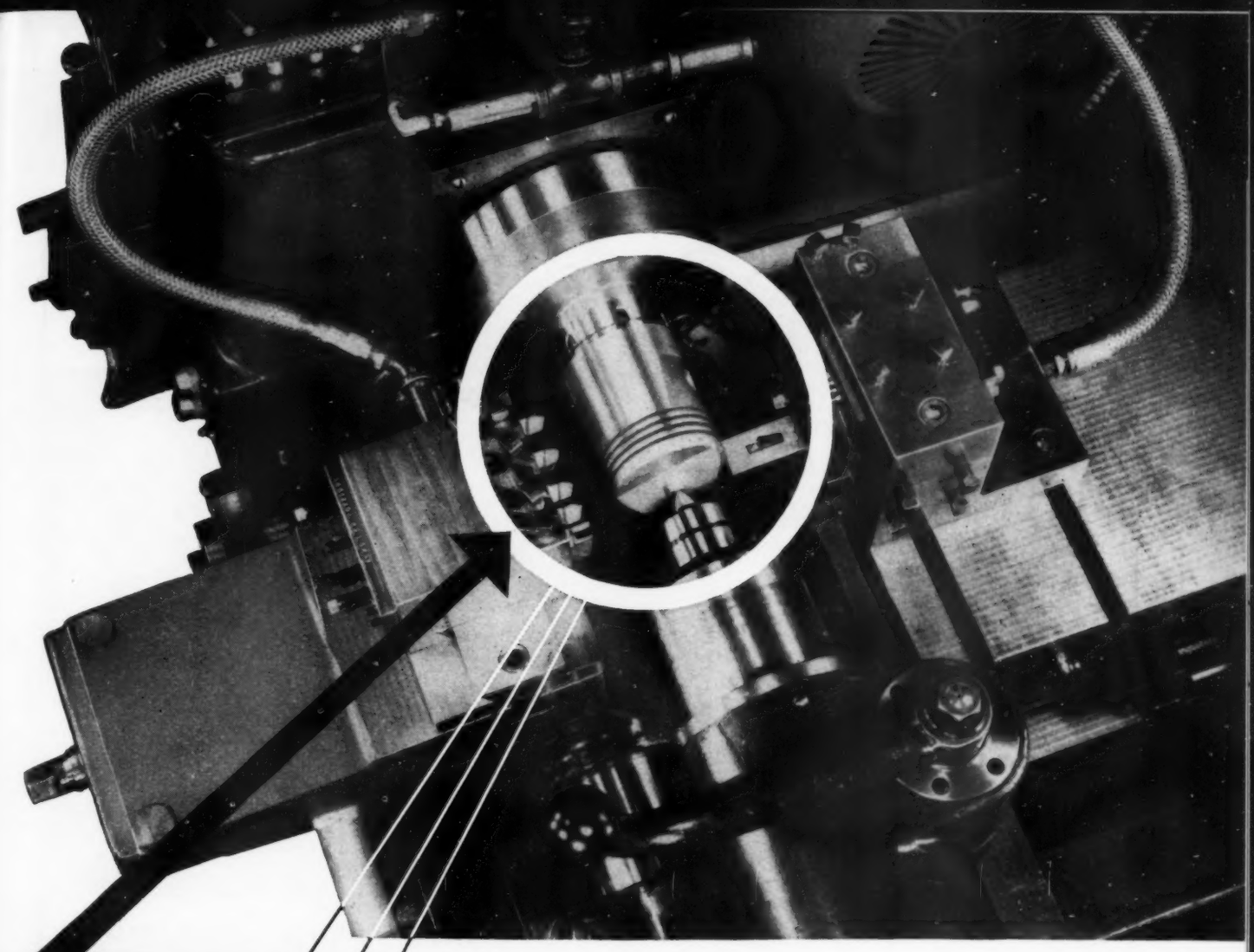
SPECIFICATIONS

Diameter, Boring Bar	6"
Travel of bar in one setting	60"
Capacity of facing heads	9" to 38½"
Widened portion of bed	51½" x 68", 18" High



SIMMONS MACHINE TOOL CORP.
1759 NORTH BROADWAY, ALBANY, N. Y.
NEW YORK CITY OFFICE: 149 BROADWAY

SIMMONS
MICRO-SPEED
LATHES · TURRET LATHES · MILLERS · BORING MACHINES



PISTONS *almost by proxy!*

Within close limits of accuracy, this Gisholt Hydraulic Automatic Lathe is finish-turning and grooving aluminum pistons at the rate of 180 per hour.

YES, here's a machine tool that can substitute and release skilled hands for other important work. It's the Gisholt Hydraulic Automatic Lathe.

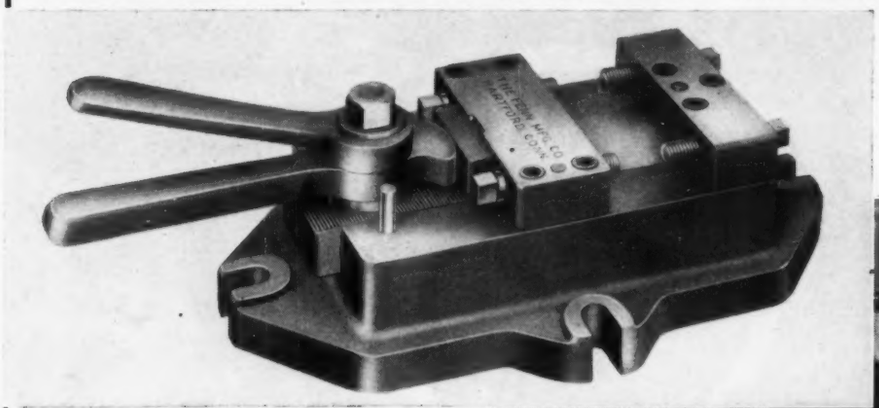
By stepping up output and reducing per-piece machining time, the Gisholt Hydraulic Automatic Lathe brings you new low cost advantages. If you have pistons, bearings, gears, pinions or other round parts to be produced in quantities, ask a Gisholt representative for all the facts.

GISHOLT MACHINE COMPANY
1201 EAST WASHINGTON AVENUE • MADISON, WISCONSIN
Look ahead . . . keep ahead . . . with Gisholt improvements in metal turning

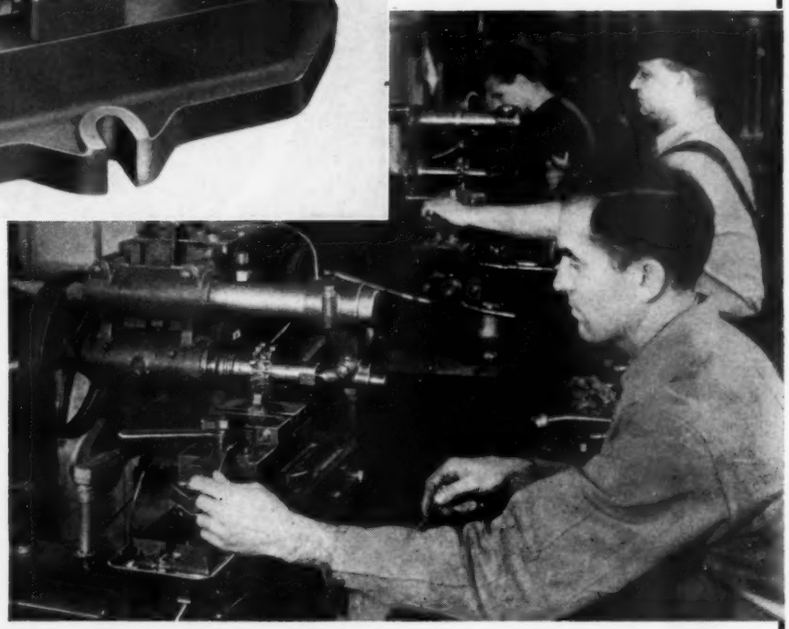
GISHOLT

TURRET LATHES • AUTOMATIC LATHES • BALANCING MACHINES

Finish 'em Faster with a Fenn!



Made in three sizes:
4" - 5" - 7"



FENN

QUICK ACTION VISES

For Milling, Drilling, Tapping and Assembling Operations

THE Fenn special features make this famous vise specially effective on milling, drilling and tapping operations—operations where speed counts. And The Fenn does this because of the quick action cam lever which throws the jaws together instantly, uniformily and securely. Then the eccentric handle locks the work in a doubly secure grip. There is a precision adjustment to the jaws of this vise that is extremely important on fine work—an adjustment that is unsurpassed.

SPECIFICATIONS OF FENN *Quick-Action* VISES

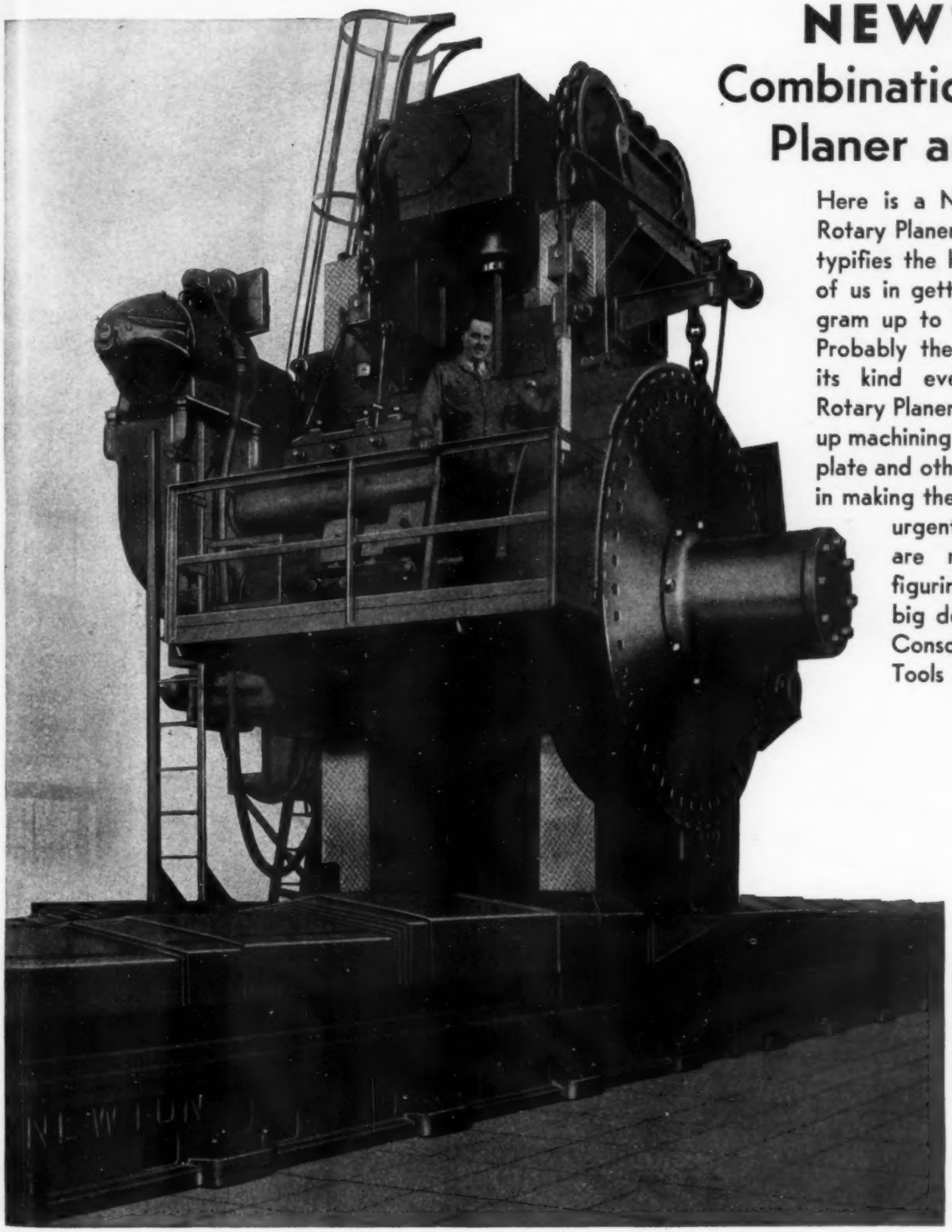
Size of Vise	4"	5"	7"
Length	10"	13"	15¾"
Width	7"	8"	8¼"
Height	4"	4¾"	6"
Net weight	21 lbs	35 lbs.	88 lbs.
Shipping weight in carton	26 lbs.	40 lbs.	93 lbs.
Extreme opening without jaws	3¼"	4 3/16"	6 7/16"
Extreme opening with both jaws	⅜" thick jaws 2½"	½" thick jaws 3 3/16"	⅝" thick jaws 5 3/16"
Maximum working opening (grip) without both jaws	2 9/16"	3 5/16"	5 1/16"
Maximum working opening (grip) with both jaws	⅜" thick jaws 1 13/16"	½" thick jaws 2 5/16"	⅝" thick jaws 3 13/16"
Width of key for locating on machines	⅝"	⅝"	⅝"
* Center distance of Bolt Holes	3 1/16"	3¼"	4"

* Bolt Holes can be located as per customer's specifications if standards do not apply.

Send for descriptive Bulletin No. 10 with complete details. Learn whether or not you can "finish 'em faster with a Fenn."

THE FENN MANUFACTURING COMPANY
HARTFORD, CONNECTICUT • ESTABLISHED 1900

AMERICA'S BIG VICTORY PROGRAM NEEDS BIG MACHINE TOOLS LIKE THIS



NEWTON
Combination Rotary Planer and Saw

Here is a Newton Combination Rotary Planer and Saw whose size typifies the huge jobs still ahead of us in getting our victory program up to its production peak. Probably the largest machine of its kind ever built, this 120" Rotary Planer and Saw is speeding up machining operations on armor plate and other tough metals used in making the defense material so urgently needed. If you are now doing or are figuring on some of the big defense jobs, see how Consolidated big Machine Tools can help you.

BETTS • BETTS-BRIDGEFORD • NEWTON • COLBURN • HILLES & JONES • MODERN

CONSOLIDATED
MACHINE TOOL CORPORATION
ROCHESTER NEW YORK

Another specialized production machine developed by Kearney & Trecker engineers to manufacture milling machines in volume and to the highest standards of machine tool precision and quality.

This 24-ton precision machine was expressly designed for multiple milling and boring operations on the horizontal and vertical columns of Milwaukee Milling Machines. A battery of these machines has helped to maintain peak production schedules and insure a higher degree of accuracy than was obtainable by other methods.

Milwaukee MILLING

The full capacity of our manufacturing facilities—operating 168 hours per week—is concentrated on the production of Milwaukee Milling Machines.

KEARNEY & TRECKER COPORATION
MILWAUKEE, WISCONSIN, U. S. A.

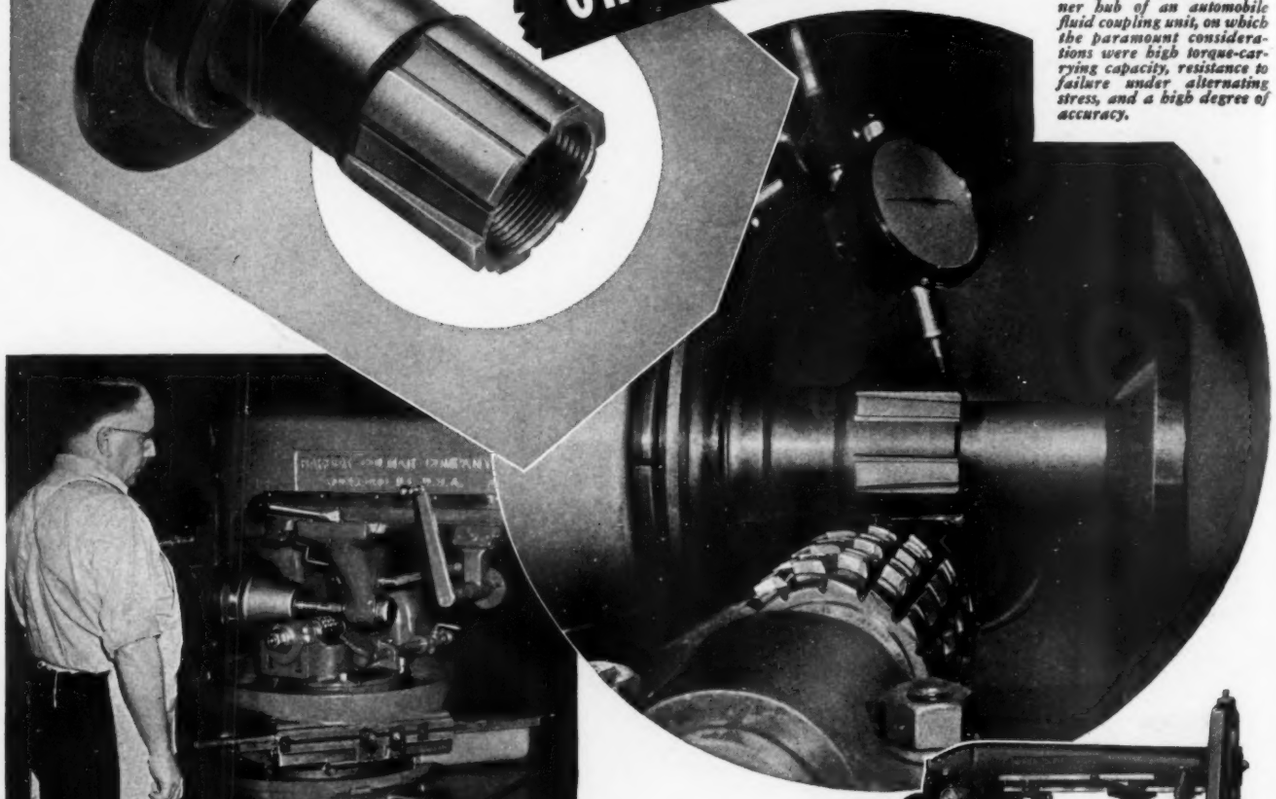
KEARNEY & TRECKER
CORPORATION
Milwaukee
MILLING MACHINES

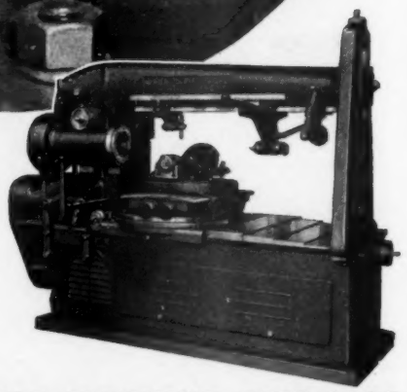
One of a series of advertisements describing specialized machines — originated, designed and built by Kearney & Trecker Corp. to assure the quality of Milwaukee Milling Machines under quantity production.

M A C H I N E S • • • •

HOBBING ACCURATE TAPER SPLINES IN ONE OPERATION ON B-C TYPE "T" MACHINE

The piece shown is the runner hub of an automobile fluid coupling unit, on which the paramount considerations were high torque-carrying capacity, resistance to failure under alternating stress, and a high degree of accuracy.





PRODUCTION DATA

Part—Fluid Coupling Runner Hub.
Material—Special Carbon Molybdenum Steel, 200 Brinnell.
Splines—6 keys, 1-11/32" length, 1½" taper per foot on root dia., 1.75" hub dia., key width 0.436"-0.437".
Holding Means—One piece per load, held in collet chuck and supported in reamed hole by arbor in outer support.
Feed and Speed—Feed .031" per rev. of work, hob speed 180 r.p.m.
Production—2.3 min. floor-to-floor time. 4 operators run 8 machines.
Inspection—A mating collar is placed on the finished splines. An indicator, pointing on this collar, must read within .0025", measured on a 4¾" radius.

Send For Literature

A copy of bulletin F-1403-2 further describing the Type "T" Hobbing Machine will be sent free upon request.

TAPER SPLINE, the newest method of keying a shaft to a hub, offers many advantages—greater strength, greater durability, greater accuracy—and is worthy of thorough investigation. Let us help you to ascertain the FACTS for any pieces on which you MIGHT use Taper Splines.

TYPE "T" TAPER SPLINE HOBBING MACHINE CAN ALSO BE USED FOR ALL OTHER KINDS OF HOBBING WORK

IT is not a "special" one-job machine, but rather a general-purpose machine with specialized features. Many present owners of Type "T" machines are turning out production runs of spur or helical gears, straight splines, pinions, or special forms on this machine when it is not in use for Taper Splines.

BARBER B-C COLMAN PRODUCTS
HOBS, HOBBING MACHINES, HOB SHARPENING MACHINES, REAMERS, REAMER SHARPENING MACHINES, MILLING CUTTERS, SPECIAL TOOLS

BARBER-COLMAN COMPANY

General Offices and Plant, 201 Loomis Street, Rockford, Illinois, U. S. A.

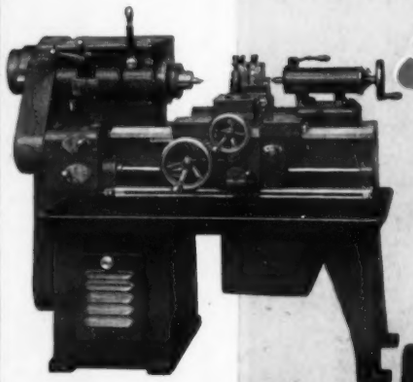
55 Years of Preparation

... make possible our contribution to defense

The nation wide acceptance LeBlond lathes enjoy among arsenals and private plants, comes as a result of continuous, uninterrupted research and development fostered by our Founder, Mr. R. K. LeBlond. Recognized as one of the outstanding leaders of the industry, Mr. LeBlond has sought constantly for better, faster, and cheaper methods of turning metal. Since he first began manufacturing machine tools in 1887, Mr. LeBlond has seen his company acquire over 210 patents protecting many exclusive features that now help so materially to speed our national defense program.

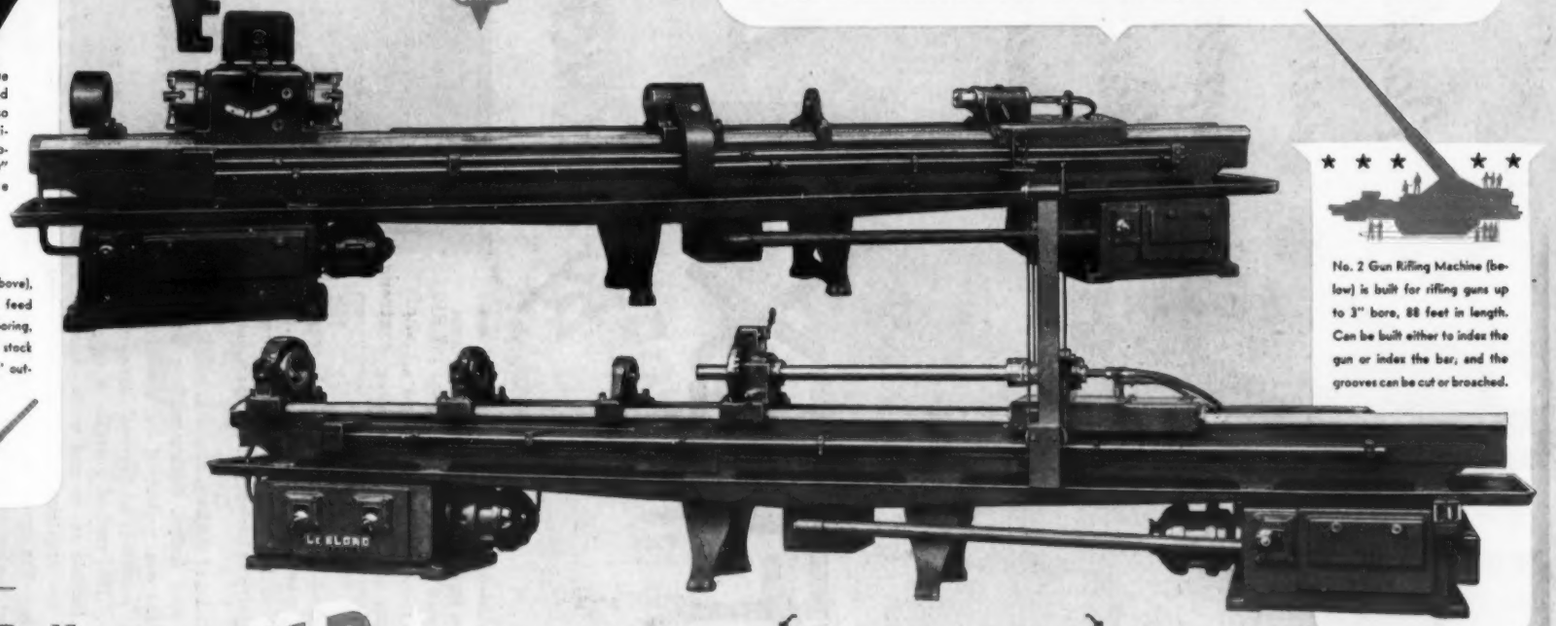
Largest Manufacturer of a Complete Line of Lathes

LeBLOND CINCINNATI, OHIO U.S.A.



13" Rapid Production Lathe (above) with high-speed anti-friction head; 13" also available with regular anti-friction, or high-speed motor headstock. 17" and 20" with 6-speed selective geared headstock.

No. 2 Deep hole borer (above), with powerful, hydraulic feed mechanism, for drilling, boring, and reaming operations on stock any length, and up to 5¼" outside diameter.



No. 2 Gun Rifling Machine (below) is built for rifling guns up to 3" bore, 88 feet in length. Can be built either to index the gun or index the bar, and the grooves can be cut or broached.

Machines shown are but two sizes and types of a complete line of gun manufacturing lathes.

THE R. K. LeBLOND MACHINE TOOL COMPANY · CINCINNATI, OHIO

Parts Production involving several operations easily handled in a single chucking

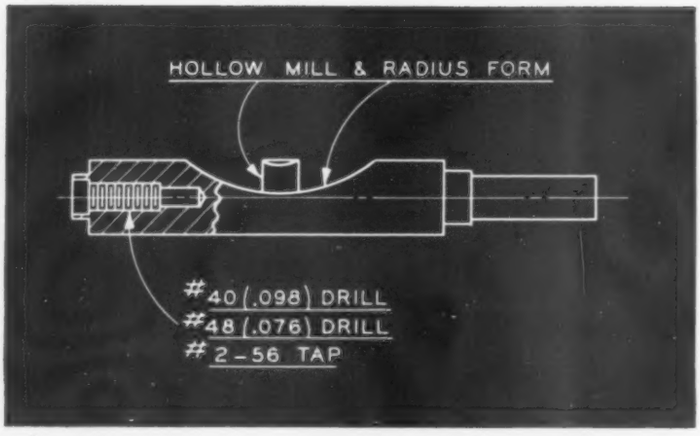
FLEXIMATIC

by KINGSBURY

The jobs for this MODEL GC FLEXIMATIC are those of drilling, tapping and hollow milling brass pins all performed accurately in a single chucking. Fast work and easy handling are assured through automatic unclamping and ejecting of the work.

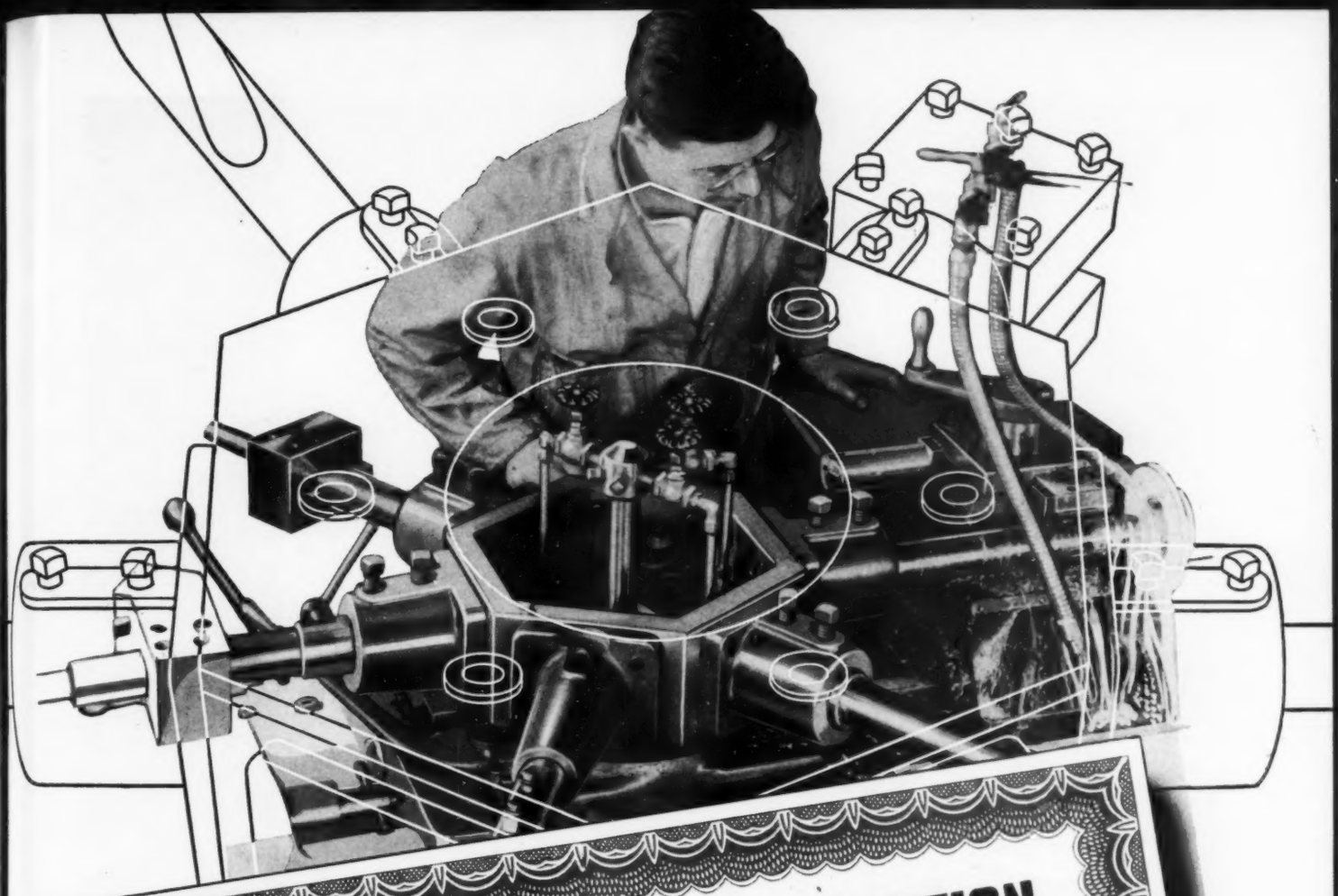
FLEXIMATICS lend themselves ideally to work of this nature where several different operations are involved in parts production, regardless of the simplicity or intricacy of the operations.

Automatically indexed drilling, reaming, tapping, counterboring, spot facing, hollow milling and similar operations are performed by individual standard units mounted on several types of standard bases. This method provides a unique combination of flexible set-up and quick change over to cover the requirements of a wide variety of machining jobs. The time for all operations on any one piece is no longer than the longest single operation because operations are performed simultaneously.



Write today for illustrated Bulletin showing a number of different set-ups.

KINGSBURY MACHINE TOOL CORPORATION
KEENE NEW HAMPSHIRE U S A



SOUND INVESTMENT IN PRODUCTION

—Present and Future

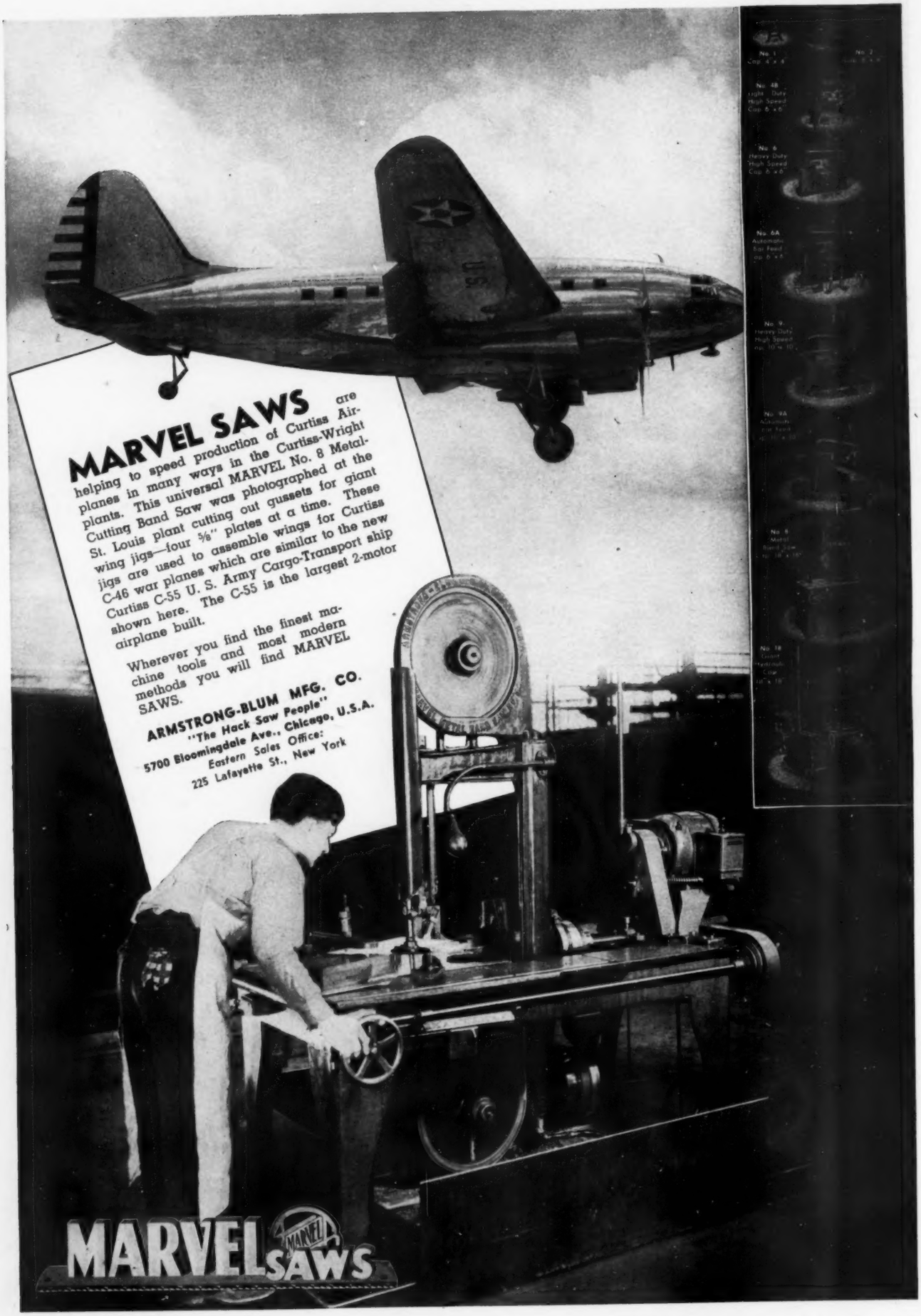
When you invest in plant equipment, look for production values—the demonstrated ability of one machine against another to produce swiftly, faithfully, and economically. Not just for the present, but over a period of years. You eliminate guesswork when you buy Gisholt Turret Lathes. You buy proved performance—known values in speed, accuracy, long life. The new Gisholts which are doing so much to speed defense production today, will also serve their owners as a hedge against whatever the post-war world may bring.

GISHOLT MACHINE COMPANY
1201 WASHINGTON AVENUE, MADISON, WISCONSIN

GISHOLT

Look ahead · · · Keep ahead · · · with Gisholt improvements in metal turning

TURRET LATHES • AUTOMATIC LATHES • BALANCING MACHINES


MARVEL SAWS
helping to speed production of Curtiss Airplanes in many ways in the Curtiss-Wright plants. This universal MARVEL No. 8 Metal-Cutting Band Saw was photographed at the St. Louis plant cutting out gussets for giant wing jigs—four 5/8" plates at a time. These jigs are used to assemble wings for Curtiss C-46 war planes which are similar to the new Curtiss C-55 U. S. Army Cargo-Transport ship shown here. The C-55 is the largest 2-motor airplane built.
Wherever you find the finest machine tools and most modern methods you will find MARVEL SAWS.
ARMSTRONG-BLUM MFG. CO.
"The Hack Saw People"
5700 Bloomingdale Ave., Chicago, U.S.A.
Eastern Sales Office:
225 Lafayette St., New York
MARVEL SAWS

TWO REASONS WHY FAST OPERATORS PREFER THE V.T.L.

BULLARD V.T.L.s
HAVE ALL THESE FEATURES

- Vertical Design
- Rigidity and Power for Carbide Tools
- 5-Face Turret on Main Head
- Centralized Control
- Rapid Power Traverse of Main Head
- 4-Tool Turret on Side Head
- Simultaneous and Independent Head Action

TWO levers control the rapid power traverse of the Bullard Vertical Turret Lathe. Today time is too valuable to be wasted by slowly and laboriously "horsing" around massive turrets and turret slides by hand.

But rapid power traverse is only one of many reasons why you save time on cuts—and between cuts—with a Bullard V.T.L.

THE BULLARD COMPANY

BRIDGEPORT, CONNECTICUT

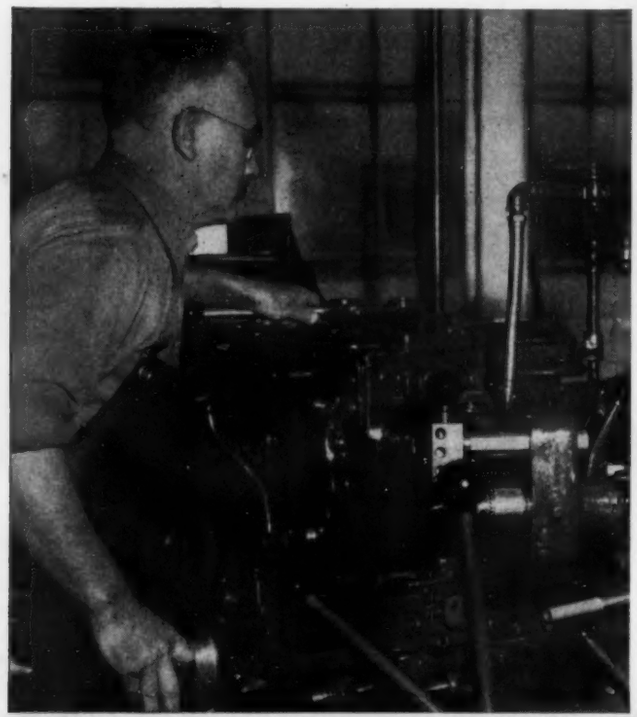
WHAT'S A GIRL POWDERING HER NOSE to do with fluorescent lighting? Just this: The powder used in G-E MAZDA "F" (Fluorescent) lamps to transform ultra-violet into invisible light must be ground fine as face powder to make sure you get maximum light for the current you buy. This synthetic powder, or phosphor, is one of many things MAZDA research created in developing this new, efficient source of light.

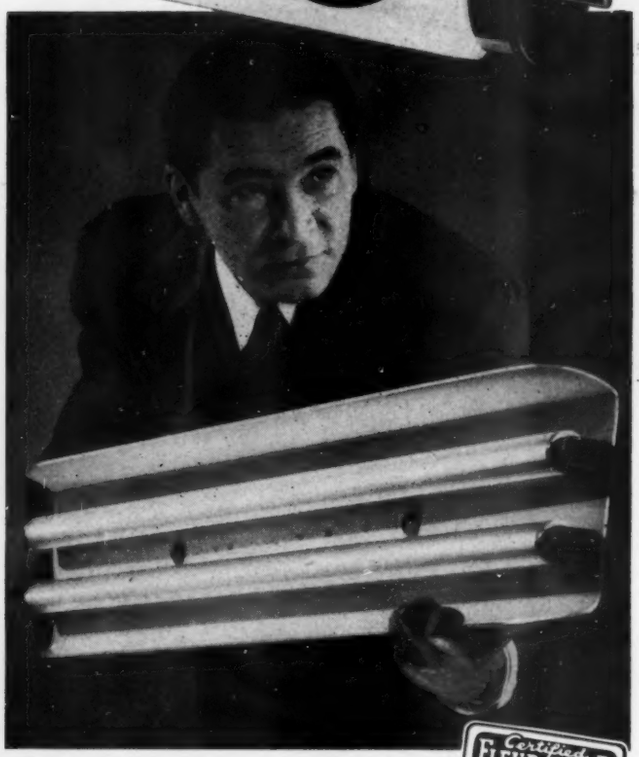
FOR FLUORESCENT LIGHTING TO SPEED VICTORY
America looks to — GE

G-E FLUORESCENT LIGHTING
is being used more and more widely in defense plants where speed and precision are so vital. The new G-E MAZDA "F" lamps give you two to three times more light for the same current. Look for the G-E monogram on every lamp you buy!

• • •

AIRPLANES, LIKE AUTOMOBILES, NEED SELF STARTERS . . . and this skilled mechanic in the Jack and Heintz Company plant at Bedford, Ohio, is helping turn out starters by the thousand for defense. A precise job—operating that turret lathe—and it's easier because of the battery of G-E MAZDA "F" (Fluorescent) lamps overhead.

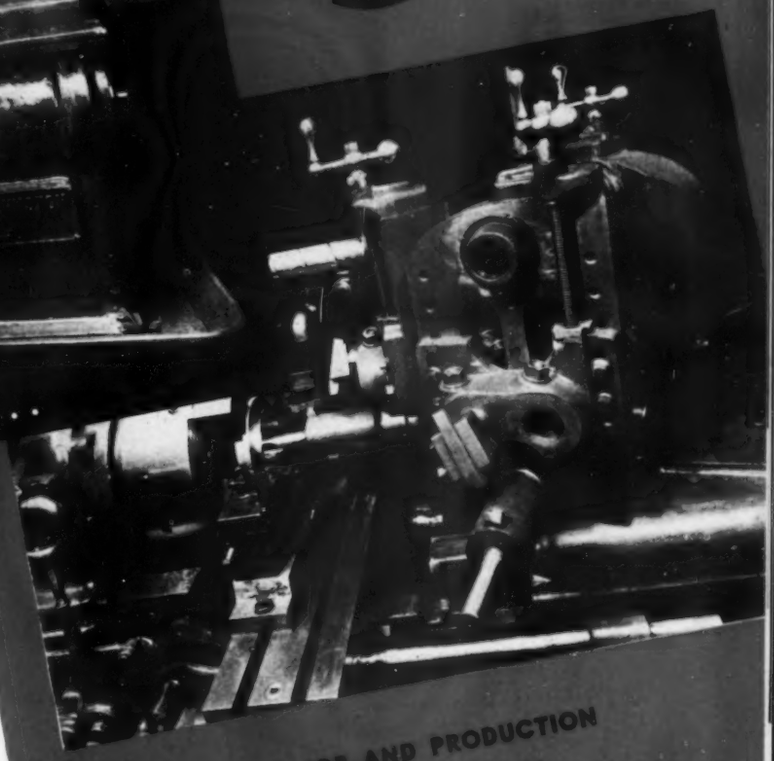




NOT A NEW SUBMACHINE GUN, but one of more than 150 tested, certified fixtures built by experienced fixture manufacturers and tested by Electrical Testing Laboratories. Look for the Fleur-O-Lier or RLM tag! See your G-E lamp distributor or write General Electric Co., Nela Park, Cleveland, Ohio.

G-E MAZDA LAMPS
GENERAL ELECTRIC

*Results FROM PLANNED PRODUCTION ON A P&J 4-D POWERFLEX



* A BEARING GAGE EVERY 3.27 MINUTES . . .

As in the larger P&J Automatic Chucking and Turning Machines, the design of the smaller 4-D Automatic has been developed to insure the extreme rigidity required to make use of present day cutting materials effectively.

The P&J 4-D Machine shown here has been equipped by P&J Tool Engineers to produce bearing cages to extremely close tolerances. The turning stem tool holders which carry a hardened and ground steel bushing, to receive the overhead pilot bar, in this case have adjustable blocks which cover a wide range of sizes, through the medium of a ball handle screw adjustment.

Of particular interest to production men is the fact that this form of construction can be used as a basis for the design of tools for P&J automatics whenever it is desirable to provide for a quick set-up from one size part to a similar one slightly larger.

Features of the P&J 4-D Automatic include: automatic speed and feed changes which assure maximum output; hardened and ground steel ways on machine bed and turret slide; automatic binding of turret after indexing; spindle mounted on Timkin tapered roller bearings; an overhead pilot of extreme effectiveness.

DETAILS OF JOB AND PRODUCTION

Part: Bearing Cage
Material: Malleable Iron
Machine: 4-D Automatic
Machining Time: One Operation only, 3.02 minutes
Floor to Floor Time: 3.27 minutes
Production per 51 min. hour: 15.6 bearing cages
Machining Operations:
1st T.F.: Rough bore 3.7⅝" dia.; rough bore 4.331" dia.; bore 4 23/64" dia. (on cut only); Rough face flange; rough turn 4.871"–4.998" dia.
2nd T.F.: Finish above cuts except as noted
3rd T.F.: Blank
4th T.F.: Ream 4.331" dia.
5th T.F.: Size turn 4.871"–4.998" dia.

POTTER & JOHNSTON MACHINE CO.

PAWTUCKET RHODE ISLAND

HANDY SELECTOR SLIDE CHART

This convenient pocket-sized guide will help you spot the Stainless analysis which best meets your Corrosion or Heat Resistance requirements. It quickly answers questions involving physical properties, and fabricating conditions.

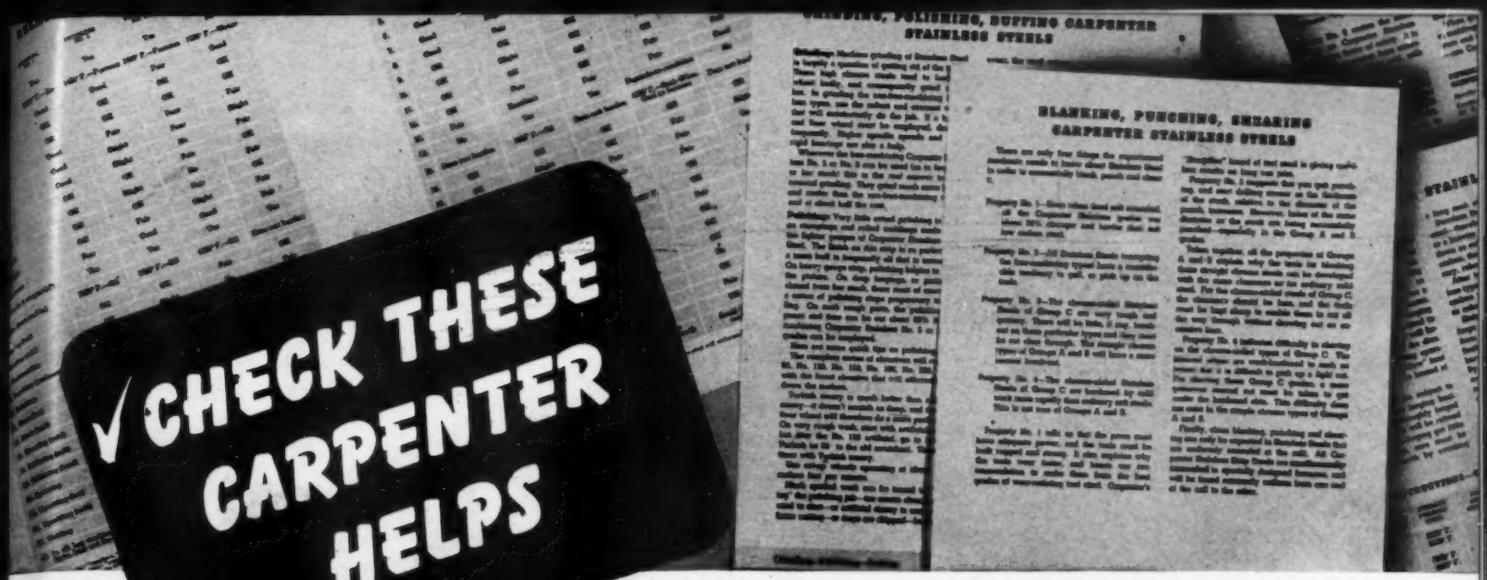
GUIDE FOR THE DESIGN ENGINEER

Whether designing for new defense applications, or to meet tomorrow's sales problem, this booklet will help you. It shows practical ways and means of designing for Stainless—how to take advantage of the added strength and rigidity of Stainless Steel—how to design for faster and easier fabrication.

FOR *quick answers* TO YOUR STAINLESS FABRICATING PROBLEMS

Carpenter

BRANCHES AT Chicago, Cleveland.



WHEN you are up against a new or difficult fabrication problem these days, you know how important it is to find the right answer quickly. Getting it right the first time can save precious hours and days, and much vital material that is needed for national defense.

Helping Stainless users to solve fabricating problems is no new job to us at Carpenter. Ever since we pioneered the first bright finish, ductile Stainless Strip . . . ever since Carpenter's original development of free-machining Stainless . . . our representatives, metallurgists and research men have been in the front line when it comes to meeting new problems.

Out of it all has come the "know how" which time after time has helped us to make the "impossible" job, possible. In keeping with Carpenter's established policy of sharing its knowledge and experience with its customers—this information has been released in printed form from time to time.

It is available to any user of Stainless Steel who would like additional fabricating information based upon the experience and research of a group of men that have pioneered in the production of Stainless Steel.

THE CARPENTER STEEL COMPANY
READING, PA.

STAINLESS SELECTOR SLIDE CHART ☐

DESIGN BOOKLET ☐

STAINLESS DATA SHEETS

Each subject is condensed into a single sheet of data covering the particular operations mentioned. Check the problem on which you would like information.

- **Machining** ☐
- **Blanking, punching, shearing** ☐
- **Forming, drawing, spinning, cold heading** ☐
- **Grinding, polishing, buffing** ☐
- **Tumbling, ball burnishing** ☐
- **Soldering** ☐
- **Welding and rivetting** ☐

A request on your company letterhead will bring you any of these Carpenter Stainless helps promptly.

THE CARPENTER STEEL COMPANY
109 BERN ST., READING, PENNA.

STAINLESS STEELS

more than corrosion resistance

Detroit, Hartford, St. Louis, Indianapolis, New York, Philadelphia

THE TOOLS YOU BUY AGAIN
Twist Drills — Milling Cutters — Reamers — Hobs — Slitting Saws — End Mills — Taps — Dies — Screw Plates — Profile Cutters.

BUY UNION TOOLS ON FAITH
...and you'll use them for RESULTS

You can come to UNION for your small tools on faith in the organization behind them. Once you've put them to work you'll find full justification for your confidence. Consistently fine performance in terms of better, faster work at lower cost is your reward for taking our word and the word of countless users for the fact that UNION sets high standards for quality and results.

UNION has maintained its leadership in small tools over a period of many years—tools that are recognized everywhere for uniformity, dependability and long-lived productivity—tools that give faithful, economical performance. Prove them by using them.

UNION TWIST DRILL CO.
Athol, Mass.

STORES New York Store: 61 Reade St.; Los Angeles Store: 524 East Fourth St.; Chicago Store: 11 So. Clinton St.; Seattle Store: 568 First Ave., So.; San Francisco Store: 121 Second St.; Detroit Store: 6540 Antoine St.

MANUFACTURING DIVISIONS

S. W. Card Mfg. Co., Div.; Mansfield, Mass.
Butterfield Division, Derby Line, Vt., and Rock Island, Quebec
Representatives throughout the world

UNION

HIT NEW PRODUCTION PEAKS!

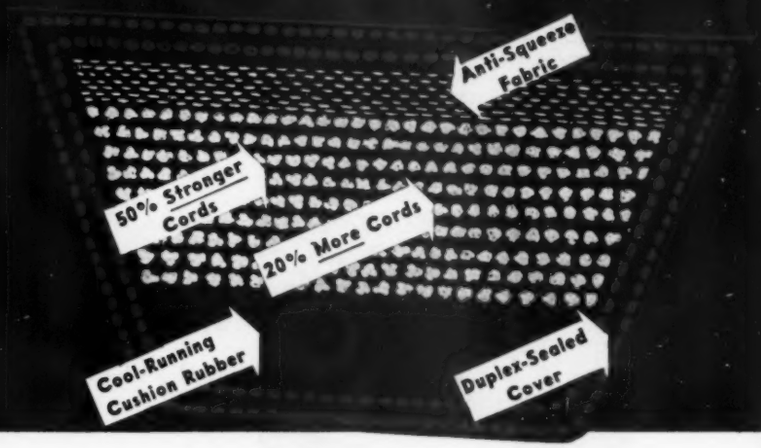
WITH NEW TEXROPE* SUPER-7

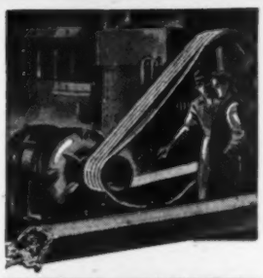
1 50% STRONGER CORDS! Sensational new Flexon process makes cords 50% stronger than even those in former great Texrope belts.

2 20% MORE CORDS! Count them! You get 20% more of these tough, extra pulling power cords in every Texrope Super-7.

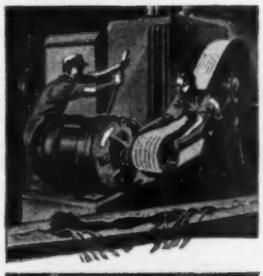
3 INCREASED LIFE! Cords float on amazing cool-running cushion rubber that absorbs shock . . . actually increases belt life phenomenally.

4 EXTRA PROTECTION! Exclusive duplex-sealed cover protects pulling cords against dirt, grit, moisture, and other adverse elements.

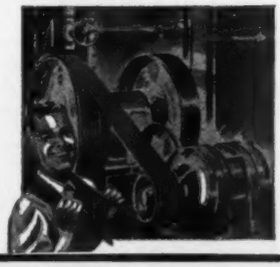




LOOK OUT FOR DANGER in belts with stiff, unpliable cords! Such belts *look* strong... but actually they buckle over sheaves, build up excessive heat that attacks pulling cords. Result: Belt failure far sooner than you expect it.



WARNING SIGN! Sagging, slipping belts mean too much stretch not backed up by balanced cord strength. Motor must be pulled back often to take up slack. Result: When stretch limit is reached belt breaks under tension.



SUPER-7 TEXROPE BELTS are made by amazing Flexon process that *combines* flexibility with low stretch... great strength. Cords float on cool-running, shock absorbing cushion rubber. Result: *true* strength . . . *true* pulling power . . . *true* endurance.

TO WIN the war—America needs top efficiency in the use of its power...

That's why Texrope Super-7 V-belts have a double-barreled value today. For here's a line of V-belts that has been designed and built to give you increased pulling strength and drive efficiency...plus longer belt life under the toughest war-time operating conditions.

In every way these belts are better—

You'll find they have 50% stronger cords! 20% more cords! A new rubber cushion section that effectively absorbs shock! Full protection against heat, dirt, moisture, and other adverse factors that quickly shorten the lives of ordinary belts.

You'll find, too, they give smooth, silent, slipless, high efficiency performance—in "matched" sets, and in sizes and types to meet your every requirement.

Whatever your war-rushed power transmission needs, don't be satisfied with anything but the best—*and that best is Allis-Chalmers Texrope Super-7—the V-belt for Victory!*

Call your Texrope dealer or the Allis-Chalmers district office near you. Or write Allis-Chalmers, Milwaukee, Wisconsin.

Available in All Sizes
½ hp to 2000 hp

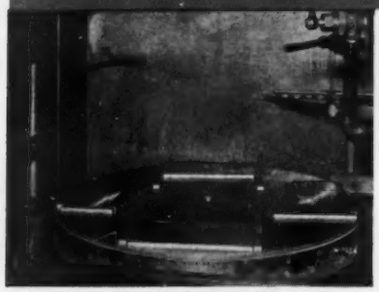
A1473

*Trade mark registered U. S. Patent Office. Texrope Super-7 Belts are the result of the co-operative research and design genius of *two* great companies —Allis-Chalmers and B. F. Goodrich—and are sold exclusively by Allis-Chalmers.

ALLIS-CHALMERS

MILWAUKEE·WISCONSIN

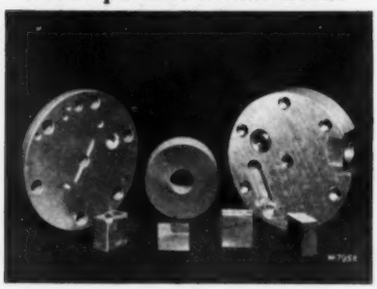
"PUT IT ON THE BLANCHARD"



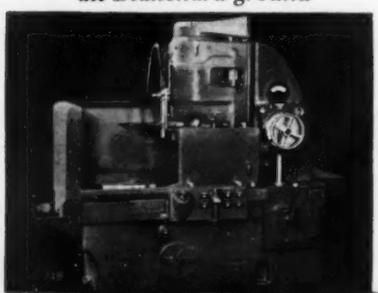
Sides ground parallel within .00015"

One end ground square with side within .0001"

Other end ground square within .0001" parallel within .00015"



End plate, roll, and blades — all Blanchard ground



No. 18 Blanchard Grinder

SQUARE

WITHIN .0001"

Two Blanchard No. 18 Surface Grinders, with Blanchard fixtures produce these refrigerator compressor blades to extremely close limits for accuracy and finish — at a rate of 1000 complete blades (ground 6 sides) every 8 hours.

360 blades are held on the chuck at one time while one side is being ground, then they are turned over and the other side is ground parallel within .00015". The ends and edges of the blades are then ground in six 10-station fixtures mounted on the chuck.

A Blanchard Demagnetizer is used between each operation on both the work and fixtures.

BLANCHARD
MACHINE COMPANY
64 STATE ST., CAMBRIDGE, MASS.

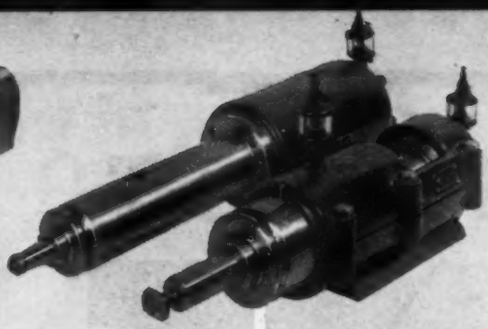
Send for your free copy of "Work Done on the Blanchard." This book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.

BLANCHARD

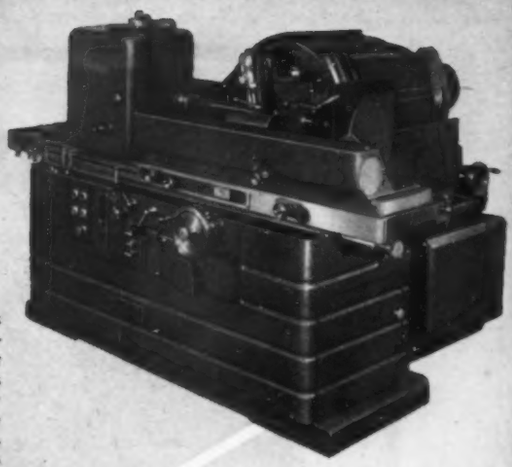
CHECK THESE ADVANTAGES OF BLANCHARD GRINDING

- ★ Production
- ★ Adaptability
- Fixture Saving
- Operation Saving
- Material Saving
- ★ Fine Finish
- ★ Flatness
- ★ Close Limits

★ . . . *Especially valuable on jobs like the one illustrated.*



ABOVE: Ex-Cell-O motor-driven and belt-driven types of spindles. *BELOW:* Close-up view of Ex-Cell-O *Precision* Ball Bearing. Through the arrangement of point contact between the ball and the race, each ball is given a gentle spinning motion that results in every part of the surface of each ball being presented for wear. This minimizes bearing wear and aids in maintaining the spherical shape of each ball. Ex-Cell-O Precision Bearings on Ex-Cell-O Spindles are interchangeable as a unit.



Precision Boring as universally used today was developed mainly through the availability of the Ex-Cell-O *Precision* spindle. Above is Style 1212-A, one of nine standard Ex-Cell-O Precision Boring Machines featuring the Ex-Cell-O *Precision* Spindle.

Thread Grinding Machines, producing work to extremely close limits, must have *Precision* Spindles. Above is Style 35 Universal, one of eight styles of Precision Thread Grinders made by Ex-Cell-O, all equipped with Ex-Cell-O *Precision* Spindles.

TO LEFT: Ex-Cell-O Style 44 Carbide Tool Grinder, equipped with Ex-Cell-O inbuilt balanced motor spindle mounted in Ex-Cell-O *Precision* Ball Bearings.

TO RIGHT: Ex-Cell-O Center Lapping Machine, Style 74, for accurately conditioning female centers. This Ex-Cell-O machine also features the Ex-Cell-O *Precision* Ball Bearing Spindle.

PRECISION *begins with the* EX-CELL-O BEARING

The greater accuracy, increased production, and better finish that a large number of manufacturers are obtaining today on Ex-Cell-O machine tools equipped with the Ex-Cell-O Precision Spindle can, to a great extent, be attributed directly to the superior features of the Ex-Cell-O spindle ball bearing—a bearing specially designed by Ex-Cell-O and precision fitted by patented Ex-Cell-O methods. For instance, many thousands of Ex-Cell-O grinding spindles with these special bearings are in daily operation throughout American industry—satisfactorily meeting all the demands made upon them by today's strenuous production pace. This is why many manufacturers of grinders use the Ex-Cell-O Precision Spindle as part of their original equipment, and why numerous metal-working plants throughout the United States insist upon the Ex-Cell-O Precision Spindle whenever spindle replacements have to be made.

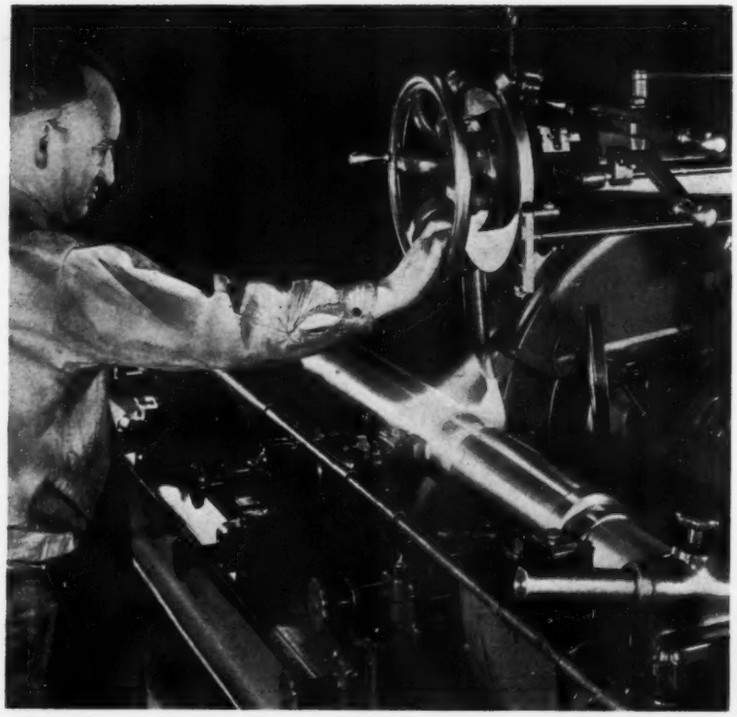
EX-CELL-O CORPORATION • DETROIT, MICH.

THREAD GRINDING, BORING AND LAPPING MACHINES • TOOL GRINDERS • HYDRAULIC POWER UNITS • GRINDING SPINDLES • BROACHES • CUTTING TOOLS • DRILL JIG BUSHINGS • DIESEL FUEL INJECTION EQUIPMENT • R. R. PINS AND BUSHINGS • PRECISION PARTS

XLO

EX-CELL-O *means* PRECISION

LET'S GET DOWN T



Left:--A close-up showing the grinding of a boring machine spindle. When finish grinding a limit of .0005" is required, but the work is actually held within a limit of .00025".

Yes, let's get down to brass tacks with an example that will illustrate just why a number of manufacturers have turned to the Landis Type B Plain Hydraulic for certain grinding needs. Take the 20" x 240" Type B Machine in the plant of a well-known maker of large machine tools.

How does he make profitable use of the high swing and long length of the Type B grinder? By grinding on it such parts as boring mill spindles 4" to 9" in diameter with lengths varying up to 15' 5", boring bars 3", 4", 5" and 6" in diameter and from 4' to 15' long and car wheel lathe spindles 19" in diameter and 3' long. When grinding jobs such as these practically the entire capacity of the machine is employed. In addition other smaller parts with lesser dimensions are often ground.

The rugged Type B Plain Grinder is recommended for the grinding of a number of large and heavy parts such as rolls, printing cylinders, large motor armatures, large lathe spindles, tank gun rotors, shafts and car axles. It is often supplied with a gapped table for grinding work having projections as, for instance, locomotive piston rods and valve yoke stems.

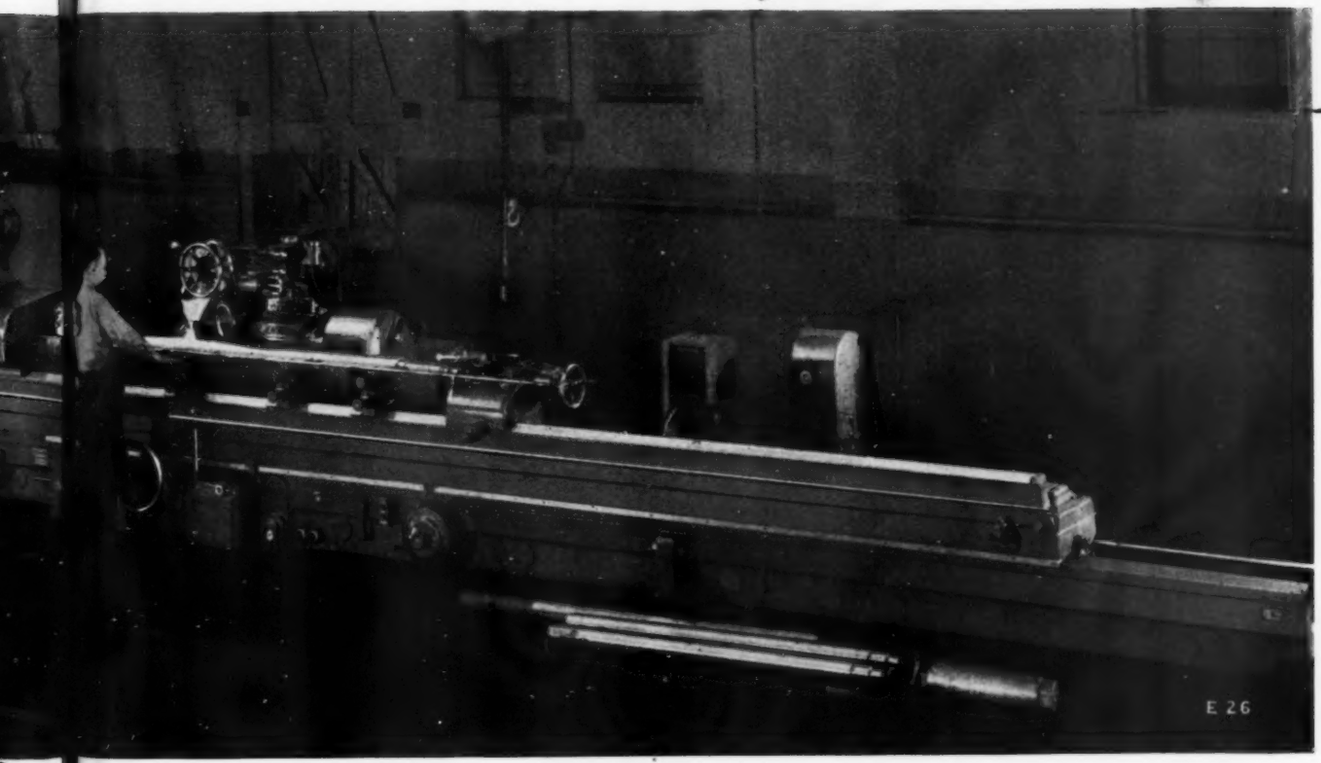
Take a look around your plant. You may be surprised at the uses you will find for this heavy and massive machine.

PRECISION LANDIS GRINDERS

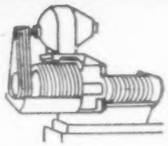
Unusual Performance As Usual

TO BRASS TACKS

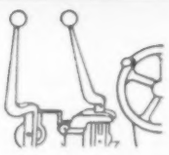
Below:--The Landis 20" x 240" Type B Plain Grinder in the plant of a leading machine tool manufacturer. This machine is ideal for grinding a variety of long heavy work.



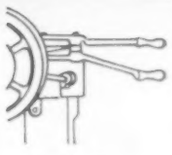
LANDIS TOOL CO. WAYNESBORO, PENNSYLVANIA



MULTIPLE V BELT HEADSTOCK DRIVE



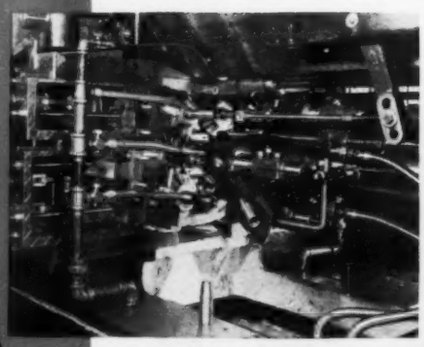
HYDRAULIC WORK TABLE TRAVERSAL WITH STEPLESS SPEED RANGE



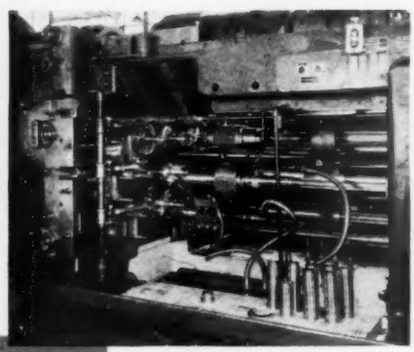
RAPID ELECTRIC WHEEL FEED

387

with **Conomatics**



37 millimeter shell bodies coming from 6 spindle Conomatic.



Fuse bodies coming from 6 spindle Conomatic.

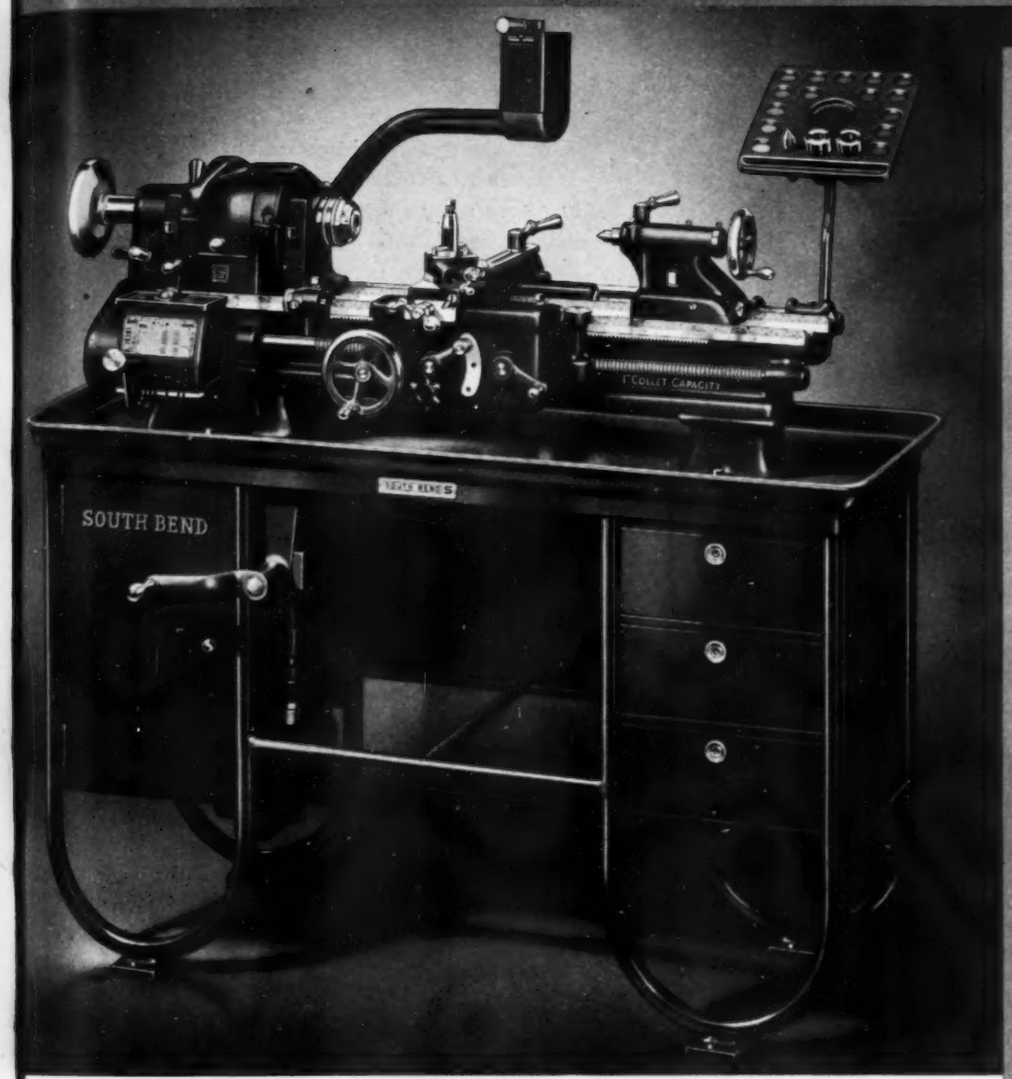
Write **now** for particulars and catalog.

CONE AUTOMATIC

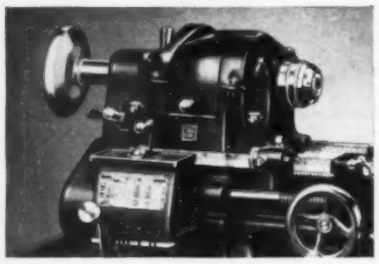
Machine Co., Inc., Windsor, Vt., U. S. A.

PRECISION

PLUS SPEED AND VERSATILITY

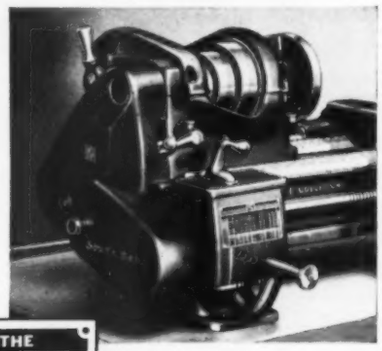


South Bend 10" Swing 1" Collet Capacity Precision Bench Lathe



Hand wheel type draw-in collet chuck for precision tool room work. Maximum collet capacity 1".

Hand lever draw-in collet chuck for rapid production operations. Maximum collet capacity 1".



Above. Headstock end of lathe showing Quick Change Gear Box. ★

Left. Index chart showing threads and feeds available through Gear Box.

10-INCH SOUTH BEND QUICK CHANGE GEAR LATHE

SLIDING GEAR	TOP LEVER	THREADS PER INCH—FEEDS IN THOUSANDTHS								
IN	LEFT	4 .0836	4½ .0743	5 .0669	5½ .0608	5¾ .0582	6 .0557	6½ .0515	7 .0478	
	CENTER	8 .0418	9 .0372	10 .0334	11 .0304	11½ .0291	12 .0279	13 .0257	14 .0239	
	RIGHT	16 .0209	18 .0186	20 .0167	22 .0152	23 .0145	24 .0139	26 .0129	28 .0119	
OUT	LEFT	32 .0104	36 .0093	40 .0084	44 .0076	46 .0073	48 .0070	52 .0064	56 .0060	AUTOMATIC CROSS FEED EQUALS ⅓ TIMES LONGITUDINAL FEED
	CENTER	64 .0052	72 .0046	80 .0042	88 .0038	92 .0036	96 .0035	104 .0032	112 .0030	
	RIGHT	128 .0026	144 .0023	160 .0021	176 .0019	184 .0018	192 .0017	208 .0016	224 .0015	

PRECISION is the first essential in modern metal working industries. But speed is necessary also, for the efficient use of fast-cutting carbide tools—and versatility, to reduce set-up time to minimum. Precision, speed, and versatility are three of the many qualities responsible for the popularity of South Bend Lathes.

The 10" Swing, 1" Collet Capacity Precision Bench Lathe shown here is engineered for the most exacting classes of close-tolerance machine work. Direct belt drive to the carefully balanced spindle assembly provides a series of smooth, vibration-free speeds ranging from 50 to 1357 R.P.M. The full quick change gear makes any of 48 different threads and 48 different feeds instantly available.

This combination of precision, speed and versatility assures an efficient output on tool room or manufacturing work—makes this lathe ideal for defense programs demanding top speed production. South Bend Lathes are made in 9", 10", 13", 14½", and 16" swing, manufacturing or toolroom type, individual motor drive. Write for catalog and name of nearest dealer.

SOUTH BEND LATHE WORKS

288 EAST MADISON STREET, SOUTH BEND, INDIANA, U. S. A.

LATHE BUILDERS SINCE 1906

How ★ Atlas SERVES THE NATION

REVERE RIDES AGAIN!

Photo by U. S. Army Signal Corps

"Keep 'em flying — keep 'em firing!" Once again that famous name "Revere" is destined to play an important part in an America at war. This time it's a modern, behind-the-lines role as Revere Copper and Brass Incorporated piles out the shell parts for Uncle Sam.

The accurately-machined rotating bands that guide the shells as they thunder from the big guns are among the important shell parts made by Revere, as only skilled craftsmen working on the metals they know best can do the job.

In Revere's Rome, N. Y. tool room, the Atlas Shaper makes snap gauges, small tools, and commutator dies.

With America in the thick of it our vital consideration is complete efficiency for top production. Use your Atlas machine tools for all small precision parts — keep your larger machines on the operations they can handle best. Forward America!

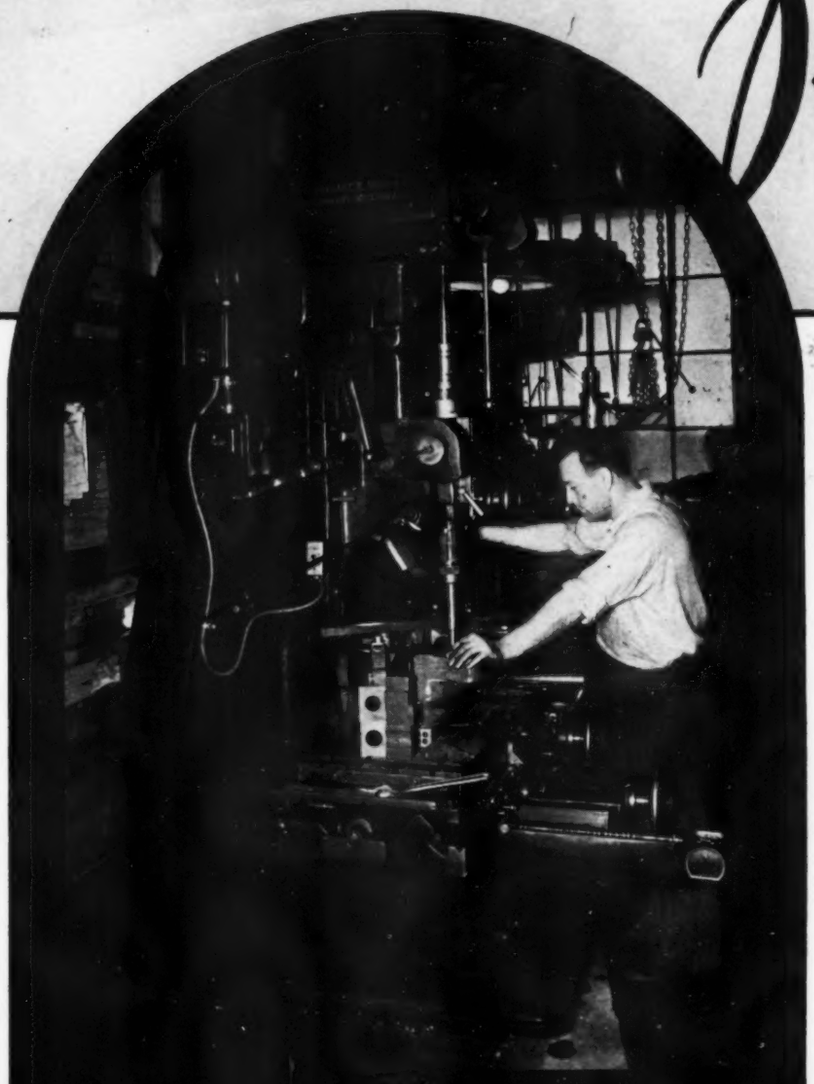
Atlas
ATLAS PRESS CO.
KALAMAZOO, MICH. U. S. A.

ATLAS PRESS COMPANY

204 N. Pitcher St., Kalamazoo, Mich.

LATHES • DRILL PRESSES • ARBOR PRESSES • SHAPERS • MILLING MACHINES

VERSATILITY
A PRIME REQUISITE TO DIE & TOOL SHOP *Production*



The
FOSDICK
JIG BORER

WHEN it is essential to produce parts in small lots and where the cost of jigs and fixtures is prohibitive the Fosdick Jig Borer is most adaptable and economical.

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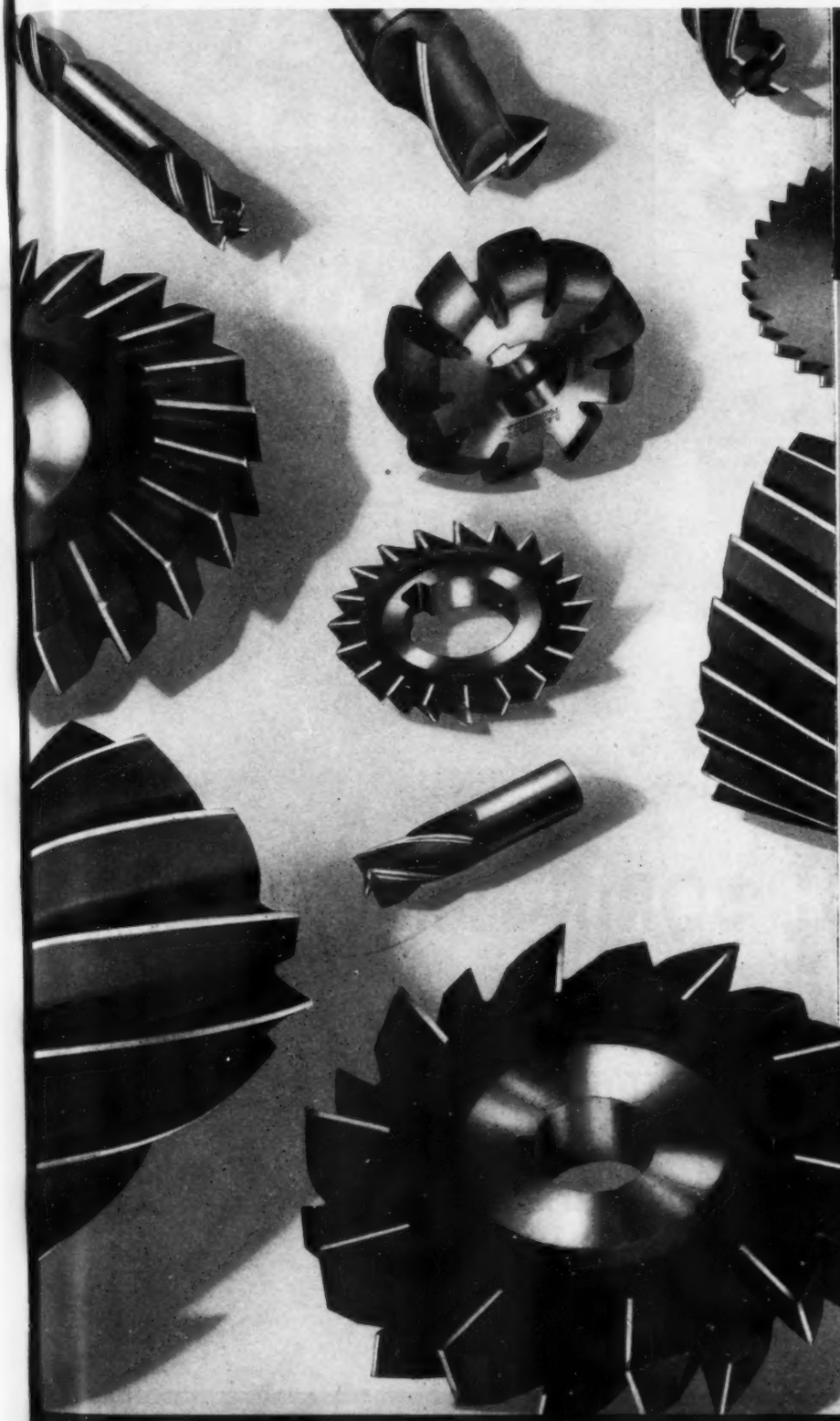

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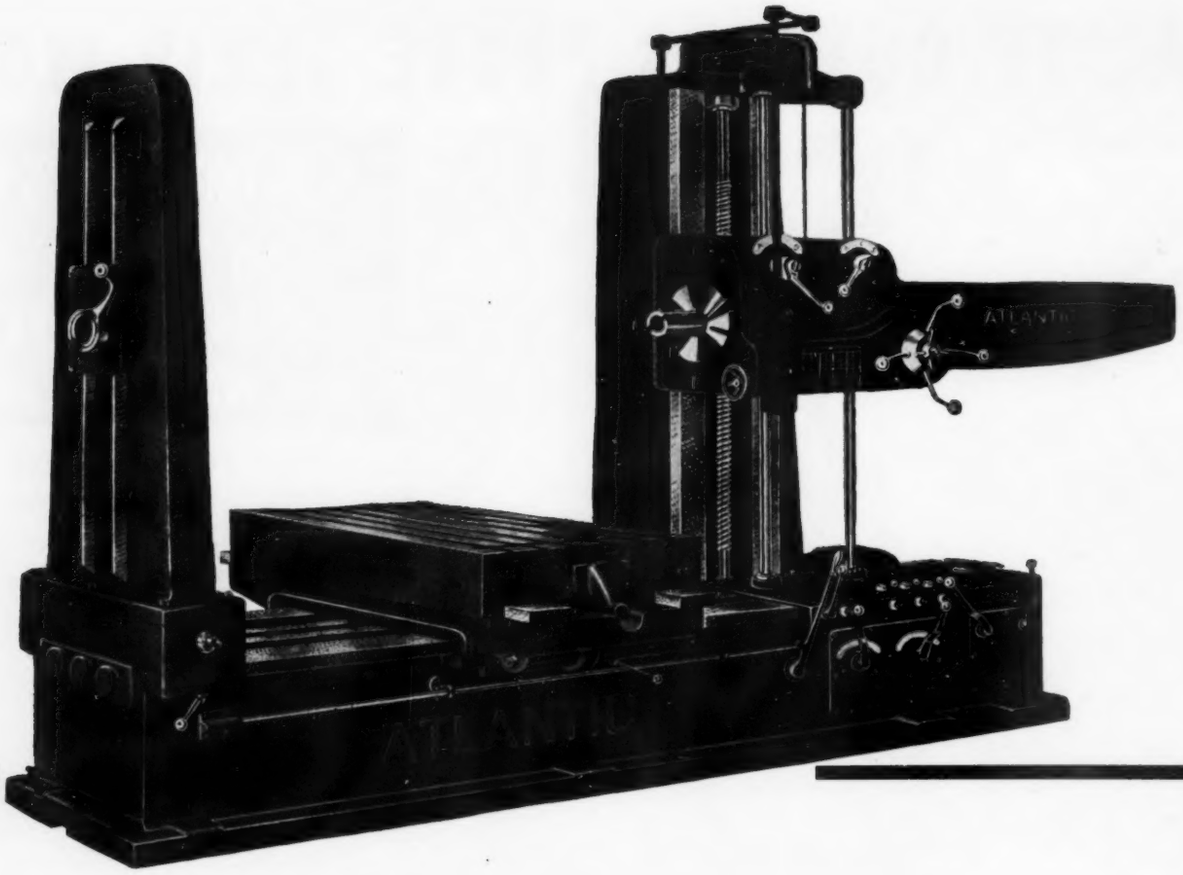

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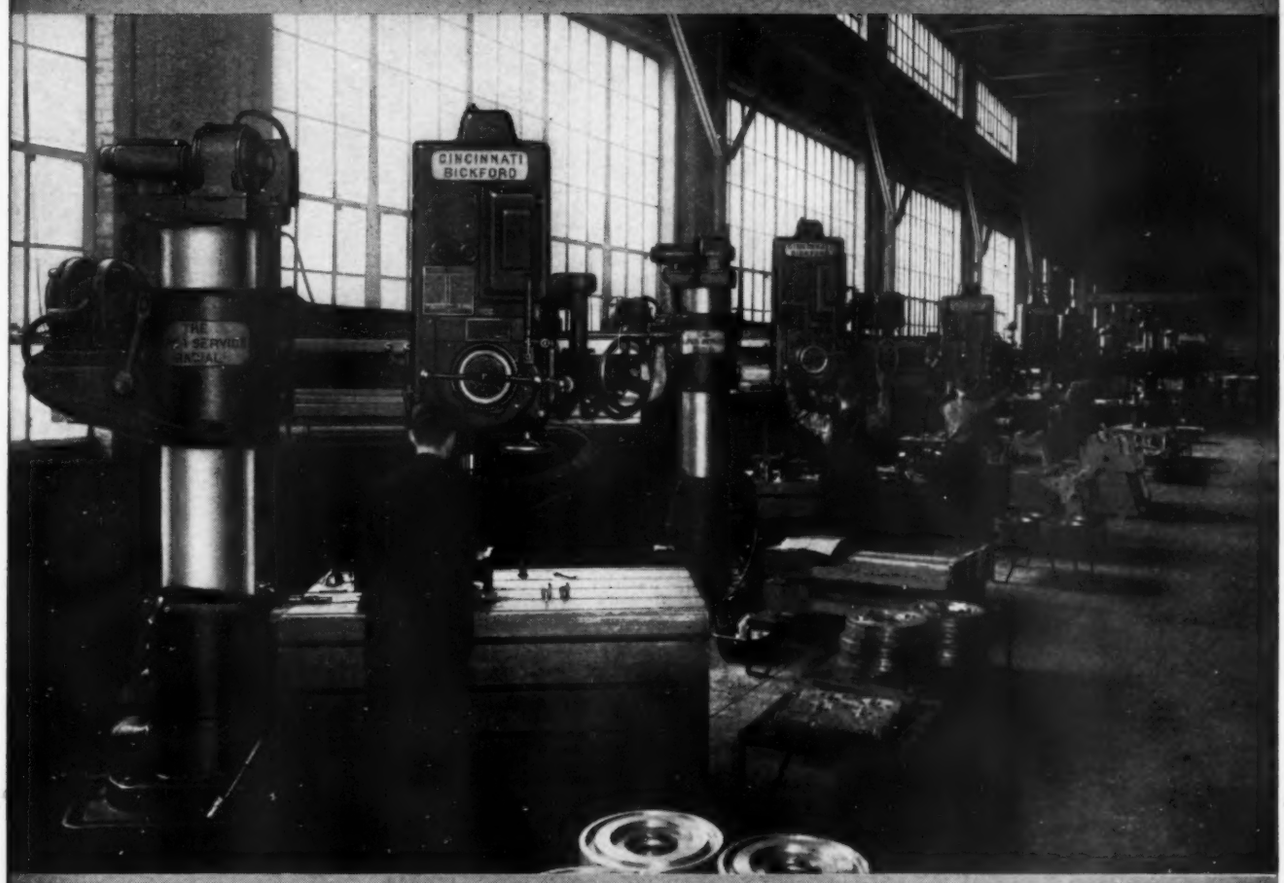

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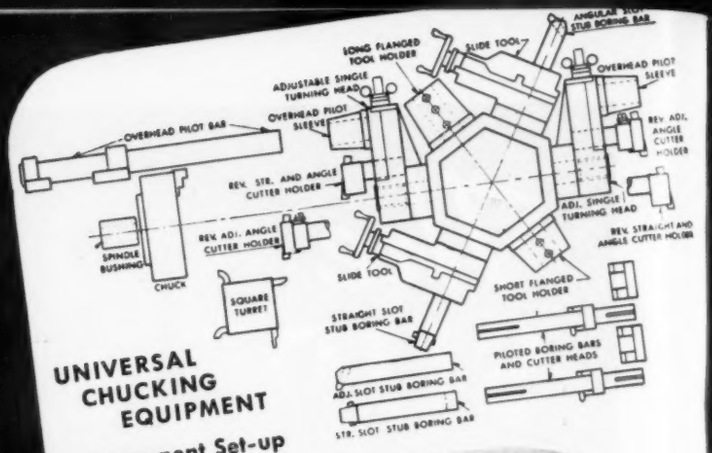
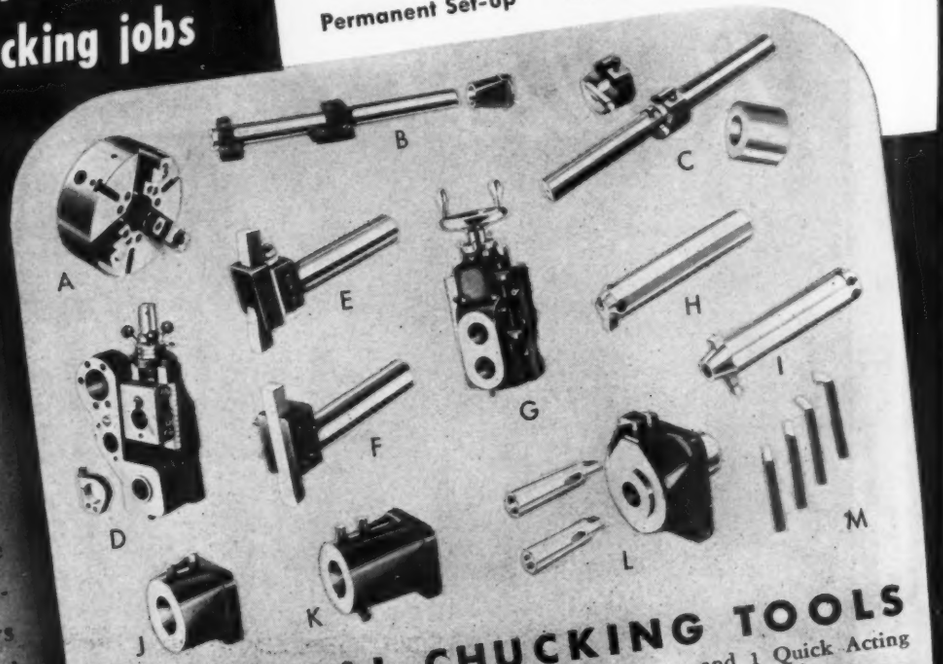


UNIVERSAL CHUCKING EQUIPMENT

Permanent Set-up

recommended to shops handling a variety of chucking work. Studies of hundreds of our customers' turning jobs show that the adoption of Universal tooling can reduce materially setup time and cut tooling costs. The heavy flanged tools remain in position. An infinite variety of jobs can be handled quickly by simply introducing shank type cutter holders and boring bars, grinding and setting cutters, and changing chuck jaws. Adjustable features in the tools themselves permit quick, accurate setting for sizes and stops. Should you need any of the small tools shown, to adopt this "permanent setup" on your Warner & Swasey Turret Lathes, select sizes from your Warner & Swasey Tool Catalog.



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G. 2 Slide Tools, or 2 Quick Action Slide Tools, or 1 Slide Tool and 1 Quick Acting Slide Tool

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J. 1 Short Flanged Tool Holder

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L. 1 Taper Socket Holder and Sockets

M. 1 Set of Forged Square Turret Cutters

WARNER & SWASEY Turret Lathes *Cleveland*

GET MORE PRODUCTION FROM Old and New TURRET LATHES

WHAT'S IN THIS ISSUE

SAVING THE SMALL SHOP

The Army, Navy and other government agencies order munitions from companies able to turn them out fast and in quantity. For many products the large manufacturer is in the best position to do this. The little fellow, the shop employing up to 50 men, seemed threatened with extinction because the loss of materials for his normal work and his inability to swing a major war order. Harrison B. Judd has organized a group of small shops in San Jose, Calif., and they are now busy on gun mounts. How his plan operates is told on page 47.

Harrison B. Judd (seated) confers with Clyde McDonald on a pending war order.

NO MORE AUTOS

The biggest conversion job undertaken by any industry anywhere is now underway in automobile plants all over the country. No more automobiles are being made—instead the industry is being prepared for 100 percent production on war needs. What this task involves, what has been done already and plans for the future are clearly outlined by Burnham Finney in an article beginning on page 61.

GUNS BY PONTIAC

Not that the automobile industry hasn't already made great contributions to the nation's armament. Many of its activities have been described in these pages. Here's another outstanding example. The Pontiac Division of General Motors is now on large-scale production on the Oerlikon anti-aircraft gun. Details of the tooling are described in this issue's Armament Section beginning page 65.

WENDELL E. WHIPP

C. D. MOORE

C. J. ANDERSEN

ANOTHER COLOR

How can a new standard color on machine tools be productive? The answer is explained by Wendell E. Whipp on page 52. A lighter color means better vision for the machine operator and also avoids the numerous exceptions that were made to the old darker machine tool gray. The new standard will avoid time lost in changing paint equipment to suit the tastes of individual machine tool buyers.

MOTOR METHODS

When the General Electric Company introduced its Tri-Clad motor it also installed improved methods for its manufacture. These include some ingenious operating set-ups on the motor frame. They are described in a picture spread by C. J. Andersen, of the G-E motor planning department. Turn to page 50.

HARD GEARS

An early and successful application of flame hardening was on large gears. Elimination of distortion and avoidance of large furnace facilities made the process particularly attractive. The technique has been improved so that today gears of all sizes are handled in this way. Typical set-ups are described by J. G. Magrath, Air Reduction Company, in the current installment of his series on flame hardening, beginning page 54.

SOME TIME SAVERS

Little ideas often save a lot of time. For instance, a simple home-made tool can be made for the drill press which will cut fiber disks of a wide variety of sizes. This is just one of a page full of interesting shop kinks prepared by A. H. Waychoff. You will find them on page 53.

STREAMLINED TRAINING

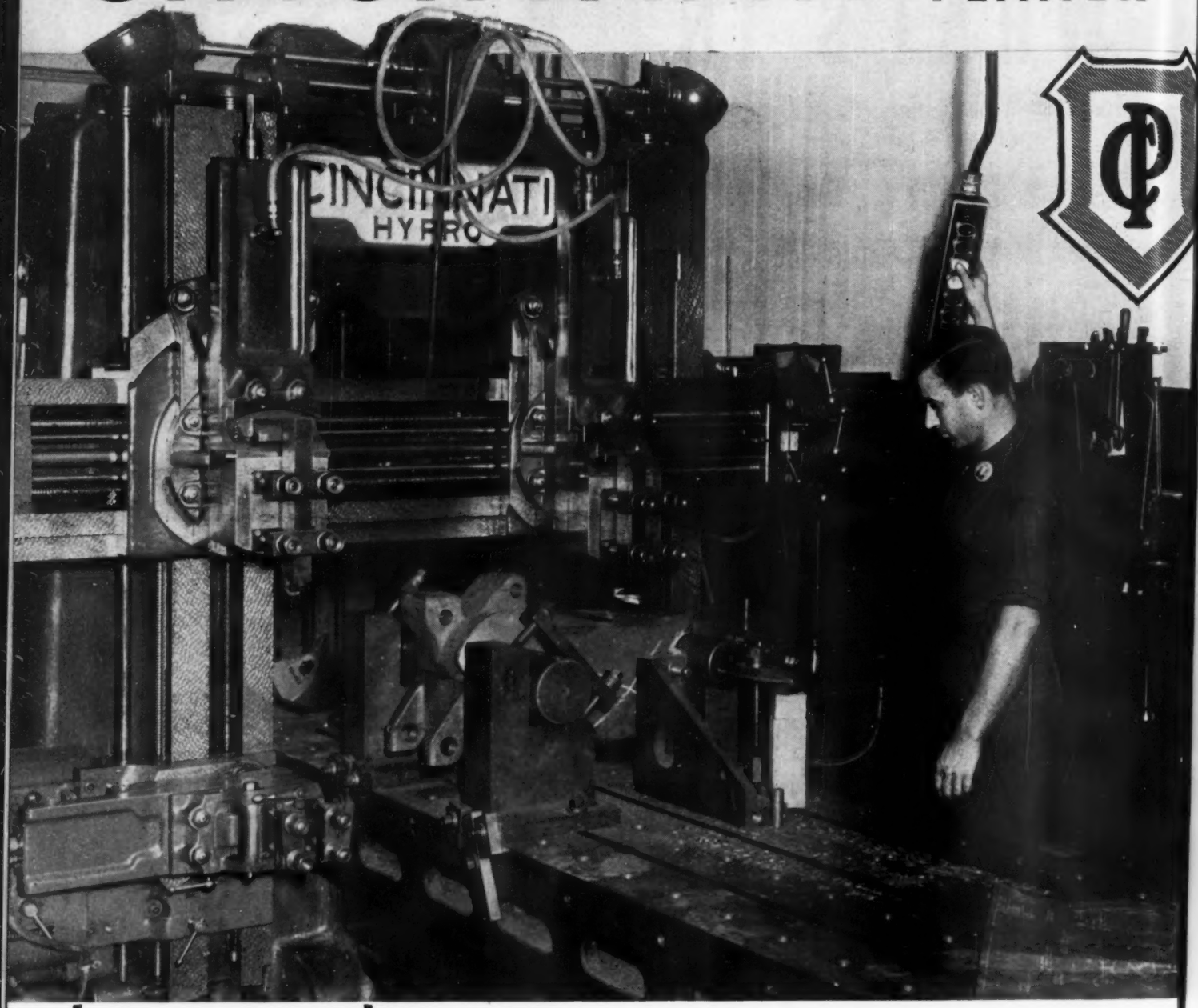
A great many organizations, governmental and otherwise, have interested themselves in the job of training men for industry. But by far the biggest share of the task has been done by industry itself. On page 79, C. D. Moore, of Westinghouse, explains the way in which his company modified its training methods to meet problems occasioned by the emergency.

COMING

Metal-working plants are expanding and will continue to do so as long as the war lasts. A big problem is the selection of new personnel and the assigning of new men and women to the tasks they can perform best. Many methods of scientific employee selection have been devised, but it takes practical experience in actual plant management to make them work. For this reason a forthcoming article by Guy C. Arthur, Jr., industrial relations manager, LeTourneau Company of Georgia, is of particular value. Look for it soon.

Another timely article to appear in these pages is a description of landing gear manufacture as carried on by the Curtiss-Wright Corporation. Jule Bemb, machine shop foreman of this company, will tell of the close tolerances needed to enable airplanes to land at high speeds on a rough terrain.

CINCINNATI HYPRO PLANER



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Machine tools in unprecedented quantities are demanded today to speed urgently needed war equipment to our armed forces.

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Here a modern Cincinnati Hypro Planer with push button control is planing parts for Bryant Chucking Grinders.

Ease of control—smooth action of Herringbone rack and complete Herringbone gear train—selective dial feed and rapid traverse to all heads and forced feed lubrication throughout are a few of the details that help produce work faster—to closer accuracies—over longer periods of time on Cincinnati Hypro Planers.

If its a Planer job put it on a Cincinnati.
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THE CINCINNATI PLANER COMPANY

CINCINNATI . OHIO . U.S.A.

ESTABLISHED 1877 AMERICAN MACHINIST BURNHAM FINNEY, Editor

San Jose's small shops stopped worrying about how to get war orders and did something about it. As a result, they are all now busily working for victory

Teamwork Wins War Contracts

OUT IN SAN JOSE, California, San Jose Manufacturers, Inc., organized by Harrison B. Judd, has demonstrated one way in which small shops can carry their share of war production. Already a group of 19 shops are setting up to turn out 300 gun carriages. How they have bid successfully and begun gathering materials is not simple. Yet, once under way, their method of operation is comparatively easy, and may be applied anywhere. Too, the Office of Production Management, the Federal Reserve and the U. S. Army Ordnance section approve the scheme. It presents no legal difficulties. You simply get together, figure a job, get the contract (provided your figures are satisfactory) and begin sweating over the work to be done.

Let's glance at the plan, from the beginning to date, for a clear understanding of the whole picture. In July, 1940, the industrial division of the San Jose chamber of commerce surveyed all machine shops in its metropolitan area. Number of men employed, floor space, type of machines available, possibility of expansion—these facts and figures were duly noted. Results of the survey were furnished to Pacific Coast aircraft manufacturers, army and navy procurement officers, government agencies, senators and congressmen. Briefly, the first attempt failed, being buried under a statement of Col. J. L. Stromme, then Industrial Planning Officer of the Army Air Corps in the Ninth Corps Area:

"You have the facilities to produce successfully, but you must sell the idea to the government and to the aircraft industry that your group can produce efficiently."

★ ★ ★

Thousands of machine shops, establishments employing from three to half a hundred skilled workers, are ready to turn their tools toward delivery of gun carriages, shells, bombs—hundreds of items the army and navy need. The really big jobs must be reserved for larger organizations. But there's no reason why "factories" can't be established in towns where a mere handful of shops now are idling on non-defense production or are busy in part on small defense jobs.

The San Jose plan is a pool of small shops and manufacturers. Jointly they have purchased heavy machinery, a condition necessary to meet before getting a contract. Unlike some "under your hat" schemes, to qualify legally the prime contractor must possess means of production himself before he can be recognized.

★ ★ ★

Col. Stromme's ideas have found expression throughout the moves made since then. Mr. Judd and his associates constantly stress the combined production ability of the San Jose shops. This is a point which must be borne in mind by any group planning a similar move. You've got to tell Uncle Sam what you can do before he will turn loose an order for war production. This is both reasonable and sensible.

Last June San Jose Manufacturers, Inc., was organized for the purpose of financing any contracts—conducting a selling campaign and furnishing financial backing should a contract be obtained. After missing on several attempts, the parent organization received not long ago a $2,000,000 award to build 300 105-mm. gun carriages. While the parent group is the prime contractor and of necessity assumes liability for performance, each of some 19 subcontractors likewise must perform or lose his part of the job.

Fountain head of the endeavor is the parent company with its physical assets. The latter consist of a forge, with seven drop hammers, and a final assembly plant—an old laundry building refitted for defense production. The parent company receives all raw materials, distributes them to the individuals and undertakes final assembly.

Agreements entered into between the pool and the subcontractors seem eminently fair to all concerned—the pool, the individual manufacturer, the government and labor. Part of the contract is a schedule of prices, based upon the machine-hour. Essentially, the subcontractor agrees to manufacture certain parts or to perform certain operations, and guarantees a minimum rate of production. His responsibility begins when the materials reach his door and ends when the completed articles leave his shop. That is, the prime contractor delivers the materials, f.o.b. truck, at the sub-contractor's plant and, when they are completed, hauls them away to the main plant for final assembly.

The prime contractor also furnishes

all special tools which may be needed, such as jigs, fixtures and dies. Thereafter, the prime contractor services and maintains these items as ordinary wear and tear make those services necessary. Naturally, replacement, maintenance and service made necessary through negligence are performed at the subcontractor's expense.

During the period the contract is in force, title to these special tools remains with the prime contractor, and when the contract is concluded, he removes them to his own premises. The same applies to unused materials.

As for actual operations, the subcontractor is not required to normalize or heat-treat any of the materials he receives. He must, however, maintain a stipulated minimum rate of production. As the parts are completed, he delivers them to the prime contractor and in return receives weekly the unit price previously agreed upon for accepted deliveries.

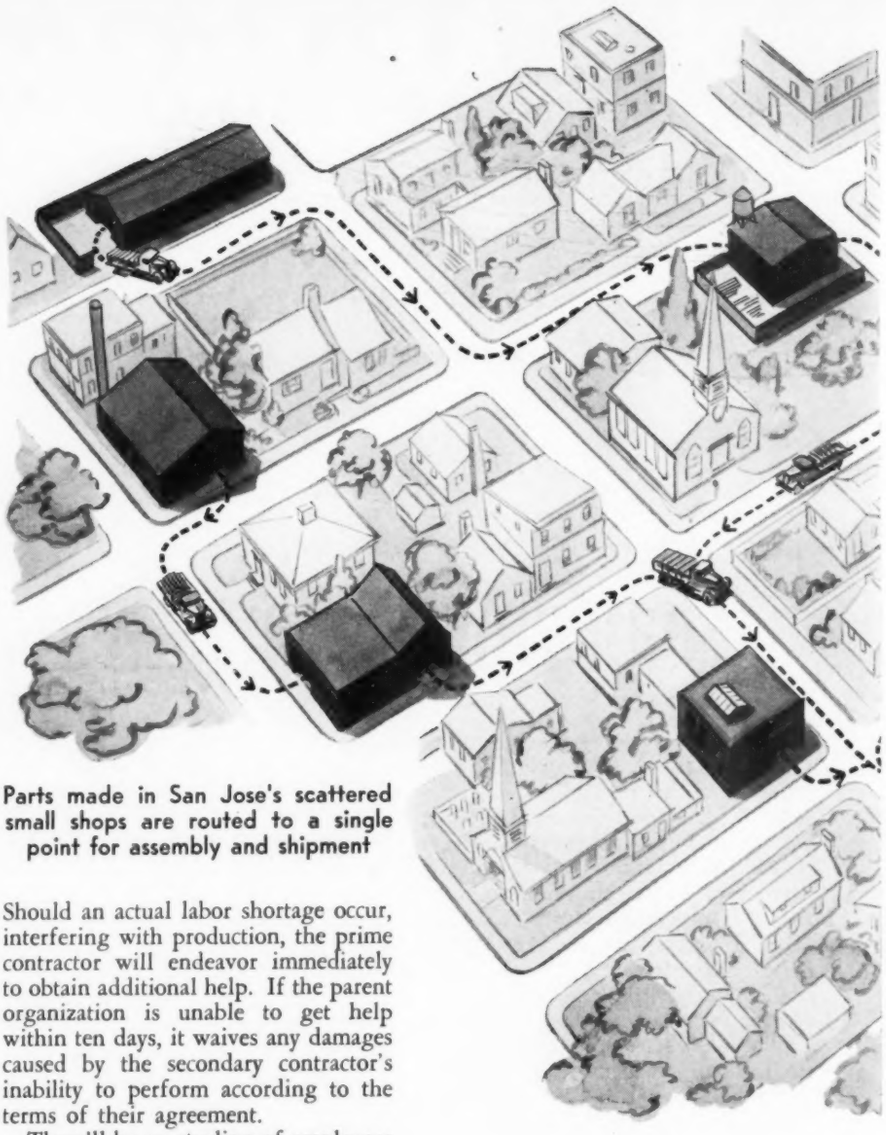
"Our obligation as the prime contractor," Mr. Judd explains, "to supply individual contractors with materials is limited to the direct materials necessary for complete manufacture of the various items. Also, at the subcontractor's expense, we supply upon his request additional amounts, but not to exceed five percent of the current value of all the direct materials necessary. Should the subcontractor spoil appreciable amounts or we reject parts as not meeting specifications, he furnishes more raw stock at his expense."

Labor Contract Specified

As for labor, the individual contractor agrees to execute a labor contract with the International Association of Machinists, A. F. of L., which contains the same terms and conditions as the labor contract in existence between the prime contractor and the union. The individual contractor also guarantees to fulfill the terms during the period of his work contract with the association.

The possibility of a rise in labor costs is not overlooked. The agreement between the prime contractor and the U. S. War Department contains an escalator clause, and any adjustment in labor wages which becomes effective between the prime contractor and the union likewise governs the small plant and the union.

Procurement of labor to keep the wheels turning in a score of plants is not left to chance. Organizers of the pool early foresaw the necessity for this task to remain in the prime contractor's control, solely for the purpose of coordinating all efforts and making sure each individual would have enough help on hand to turn out his work.



Parts made in San Jose's scattered small shops are routed to a single point for assembly and shipment

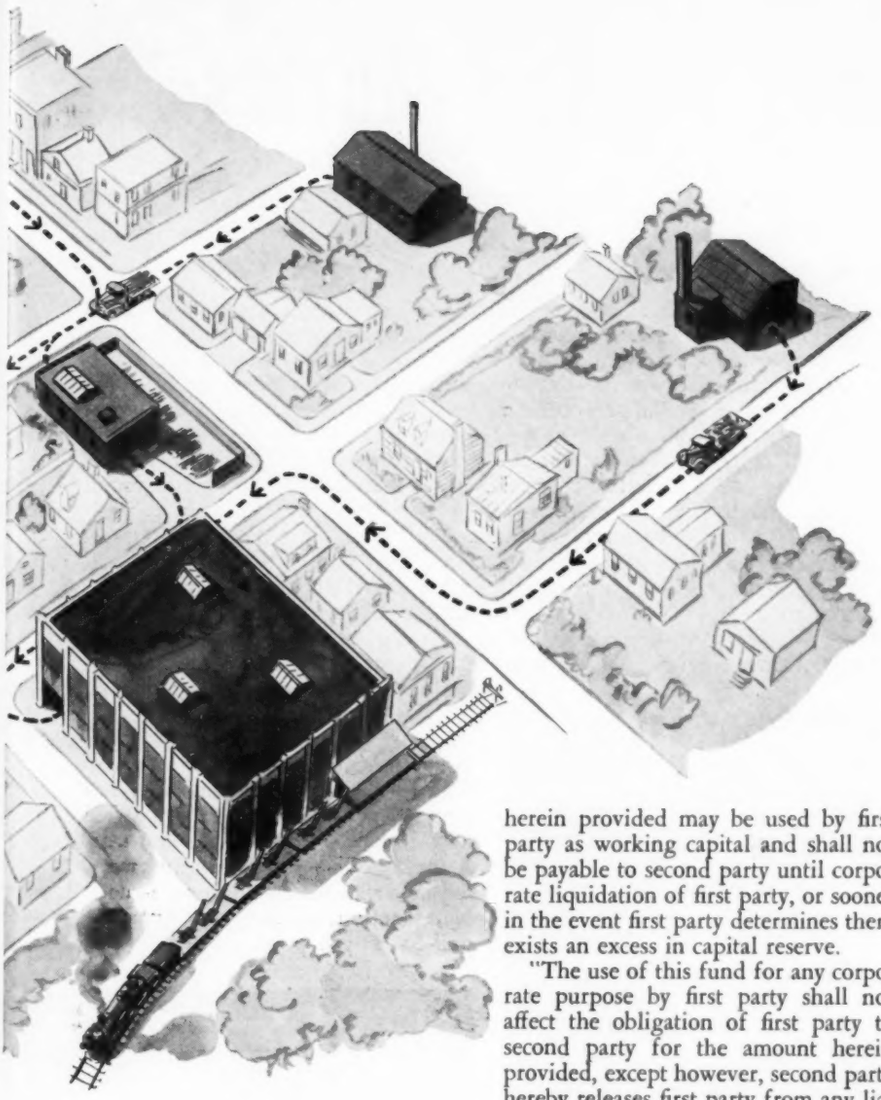
Should an actual labor shortage occur, interfering with production, the prime contractor will endeavor immediately to obtain additional help. If the parent organization is unable to get help within ten days, it waives any damages caused by the secondary contractor's inability to perform according to the terms of their agreement.

There'll be no stealing of employees from each other in an effort to obtain temporary advantages. Several provisions guard against this contingency. First, the subcontractor must not pay any employee covered by a union contract more than the minimum unless he obtains consent of the prime contractor. Second, he must neither employ nor attempt to employ anyone presently working for another subcontractor. Nor may he hire anyone employed within the last 30 days by another subcontractor, unless the workmen had been discharged or left the former employer for some reasonable cause.

Subcontractors Share Profits

An interesting feature of the contracts calls for sharing by each subcontractor in the profits to the extent he participates in the total contract. On each contract, 100,000 shares of stock are issued. Of these, 30,000 shares are distributed for sharing by the individual company. Since this plan may be adopted in other communities, it may be worth while to set down here those provisions of the contract bearing upon profit sharing:

"7. As further consideration for the execution of this agreement, and the full and faithful performance thereof by second party, first party agrees to deliver to second party, subject to the escrow provisions hereinafter set forth, ——— shares of the capital stock of first party; (the above number of shares of stock shall represent that proportion of 30,000 shares, to wit, 30 percent of the authorized capital stock, that the total dollar volume of manufacture set forth herein bears to the total dollar volume of manufacture undertaken by all participating subcontractors of first party . . . The shares so to be delivered by first party to second party shall be delivered by first party to a bank as escrow-holder, approved by both parties to this agreement . . . All dividends of earnings declared on the stock so placed in escrow shall belong to second party. . . .



"8. In further consideration of the faithful and complete performance of this agreement on the part of second party according to the terms hereof, second party shall receive from first party the following:

"(a) Subject to the provisions contained in subsection (c) of this paragraph numbered 8, that share of one-third of the net profits of first party, that the dollar volume of manufacture produced by second party bears to the total dollar volume of manufacture required for the complete performance of first party's contract with the United States of America above mentioned. In computing this ratio, the cost of articles purchased from outside sources or produced under a straight contract of manufacture are not to be included.

"(b) A share of another one-third of the net profits of first party equal to that amount specified in (a) above, will be placed in a capital reserve account of first party and credited to the account of second party. The fund herein provided may be used by first party as working capital and shall not be payable to second party until corporate liquidation of first party, or sooner in the event first party determines there exists an excess in capital reserve.

"The use of this fund for any corporate purpose by first party shall not affect the obligation of first party to second party for the amount herein provided, except however, second party hereby releases first party from any liability or claim due to a proportionate shrinkage of said fund caused by a subsequent loss or liability imposed upon the first party. In the event of any such subsequent loss or liability this said fund shall be decreased proportionately with the total working capital of first party . . . "

Access Given Inspectors

Some difficulty was encountered prior to the advent of war in that certain bidders refused to permit inspectors of the Army Ordnance Department to inspect their plants. This reluctance to cooperate now has disappeared. In fact, each contract stipulates that inspectors may enter the plants at will; further, the subcontractor must keep daily production records and time cards, and furnish the prime contractor with copies. As a further guarantee that work is progressing satisfactorily, the subcontractor provides inspectors for the prime contractor with any necessary additional information to compile a running daily record covering the entire enterprise. The parent organization furnishes all necessary policing of individual plants and the secondary contractor, for his part, guarantees to comply with all government regulations imposed upon manufacturers engaged in production of war supplies.

What happens should the work prove defective, or fail to meet specifications established by the Ordnance Department? Simple. The prime contractor may notify the individual of his intent to terminate the agreement. Now the individual has ten days' grace in which to demonstrate his ability to produce in accord with specifications. If he fails, the association may terminate the agreement, whereupon the subcontractor loses all interest to the stock shares and extra compensation.

There's to be no waste, either, for metals are precious these days. All scrap, salvage and rejections resulting from the subcontractor's work are the property of the prime contractor; and the subcontractor must gather up these materials and keep them in a special bin, from which the prime contractor collects them at intervals.

Provision for Contingencies

There are, too, a few additional provisions of interest. Unexpected contingencies, as fires, strikes or accidents to the plant, permit the prime contractor to cancel. The subcontractor cannot assign his rights to another manufacturer, except by permission of the prime contractor. If the government terminates its master contract with the prime contractor, for reasons other than dereliction on the part of the prime contractor, the latter may terminate the contracts with individual plants. In such event, the secondary contractor must deliver to the prime contractor everything connected with production, including drawings, spare parts and work in progress. Under these conditions, the prime contractor will pay the subcontractor for all expenses he has incurred, together with any costs incident to terminating and preparing these goods for delivery. A fair price would be paid for partially completed work.

As for financing, this is handled through a local bank, at the suggestion of the Office of Production Management. The note covering the purchase of drop hammers, for example, was signed by the association and indorsed by each member. So well does the scheme promise, that San Jose expects to lose few skilled men to distant plants. The city has no large manufacturing plants as is true at York, Pennsylvania. But she is pulling herself up by her bootstraps and sets an example that may well be emulated in many other communities.

New Methods on New Motors

BY C. J. ANDERSEN, MOTOR PLANNING DEPARTMENT, GENERAL ELECTRIC COMPANY

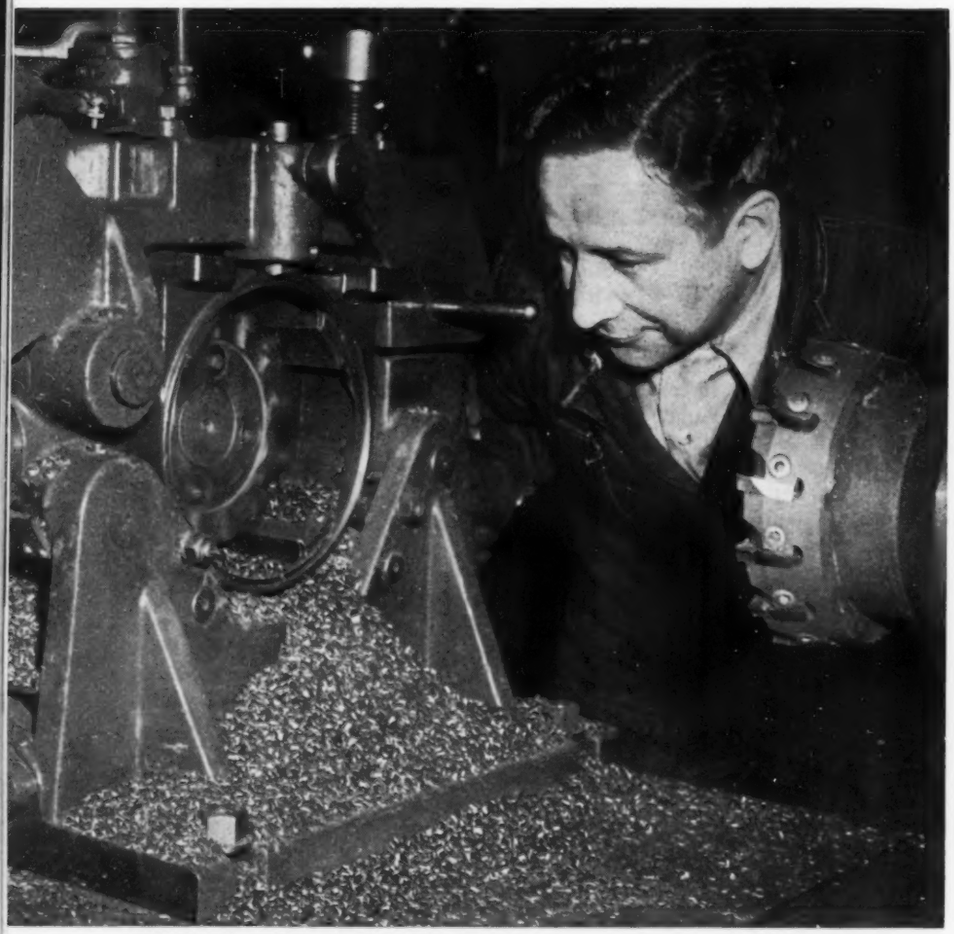
RECENTLY GENERAL ELECTRIC introduced a new line of induction motors—called Tri-Clad—which represented one of the most extensive product changes in the history of the company. In setting up to produce these motors the manufacturing department was called on to (1) contribute to a better motor by precision machining and assembly, (2) provide a production system capable of handling a wide range of types and sizes that can produce motors speedily, and (3) produce the improved motors with a minimum of additional cost, if any.

Consideration was given to a steady flow of work-in-process material, a low inventory, a minimum of lost motion, coordinated operations and carefully placed job locations.

The equipment employed at the Lynn River Works is especially designed to accomplish these objectives, conventional machines being employed only where they meet the requirements completely. For flexibility, two frame sizes are processed with one group of machines. The sequence of operations employed was influenced by the variety of types of motors to be made, so that common tooling and minimum set-ups would suffice for the greatest volume.

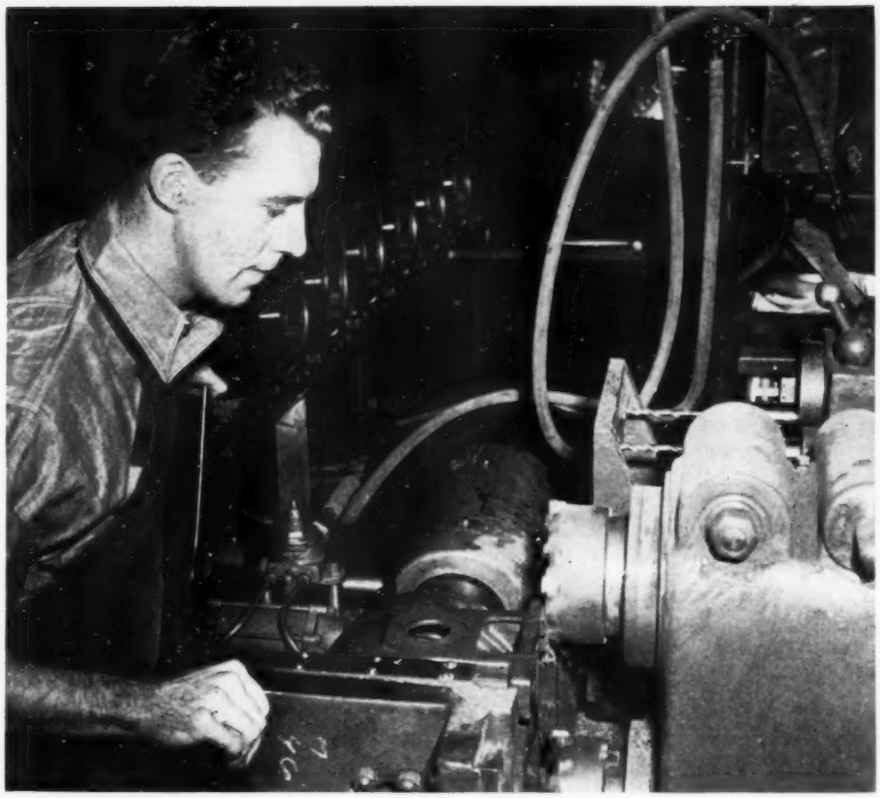
Sequence of operations on frames for Tri-Clad motors is as follows: (1) Rough and finish bore frame and rough machine recesses for end shields; (2) broach axial keyway; (3) machine annular-ring retaining grooves; (4) press laminations to proper height; (5) assemble laminations in frame under pressure, holding them with retaining rings; (6) precision grind the bore of laminations; (7) mill and drill feet of frame; (8) drill end shield bolt holes and conduit box holes; (9) tap end shield bolt holes and conduit box holes; and (10) precision machine recesses for end shields.

Individual laminations are assembled in bundles and pressed prior to assembly in the frames. Each lamination has a keyslot which matches the key placed in a broached keyway in the frame. Assembly of laminations in the frame, together with the locking ring, is done in one operation using an hydraulic pull-down type press.



First operations on the cast-iron frame are performed in a double-end boring machine designed for the interrupted cut in rough and finish boring the lamination pads. The fixture locates the frame from the outside diameter, facilitating the boring of horizontal frames with or without feet in the same fixture with minimum changes of set-up. Boring heads and cutter blocks are presized in a central tool-grinding section in order to obtain close size control

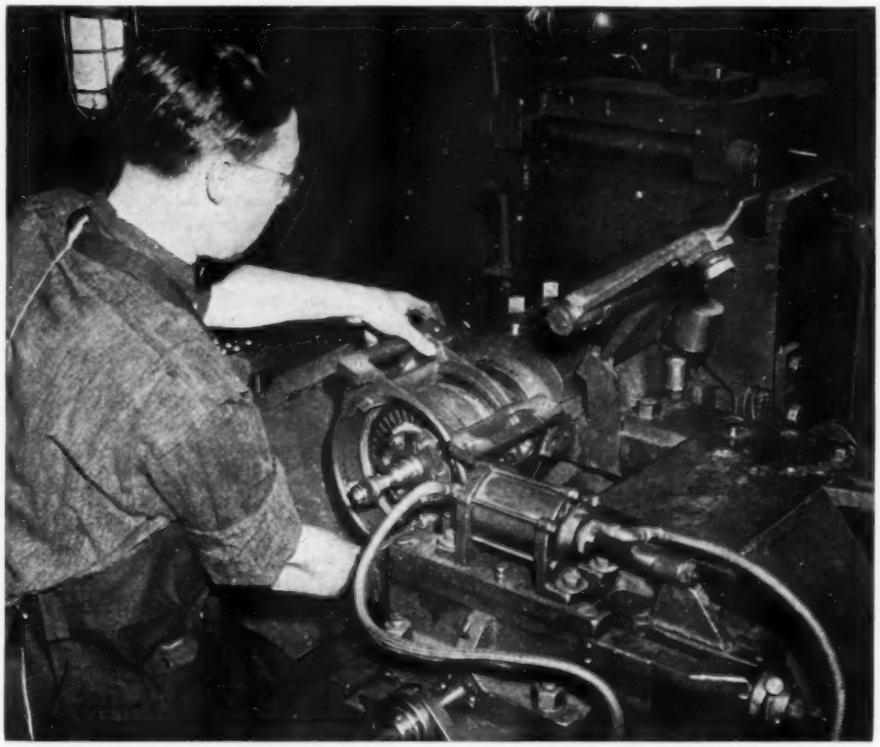
The bore of the assembled laminations is ground in a semi-automatic internal grinder equipped for automatic sizing. Diametrical location is taken from the bore of the frame and longitudinal position from the previously machined recesses. This operation is the first step in securing the air-gap concentricity necessary for good motor performance



End-shield bolt holes and conduit box holes are drilled in a horizontal hydraulic machine having a four-position, automatically-indexed rotary table. A tunnel-type fixture mounted on this table locates the frame with disappearing pins that fit snugly into diagonal holes in the feet. Two different sizes of frames having the same drilling may be handled in this machine with minimum set-up changes. Indexing is controlled by a four-sided rotary trip dog bracket interlocked with the table so that the unit always advances in correct relation to the table and the holes to be drilled.

Drill spindles are so arranged that when conduit-box holes are being drilled, end shield bolt hole drills are in the clear. When the end shield bolt holes are drilled, the conduit box drills are also clear in the bore of the frame. For frames without feet, special tooling is provided for the same fixture, using adapters which simulate the feet on regular frames. A similar machine is used for tapping

Milling the feet on horizontal frames is performed in a semi-automatic horizontal two-spindle machine having a second position for drilling bolt holes in the feet. Here the feet are milled in one plane to close tolerances of flatness and parallelism with the axis of the bore. After the milling cut, the table of this machine travels automatically to a set position for jig-drilling the bolt holes. The drilling unit consists of a conventional four-spindle, semi-fixed head attached to an hydraulic unit. For slight changes in bolt centers, all four spindles are quickly adjusted to a secondary fixed location. As in the boring machine, platen travel is controlled by solenoid-operated hydraulic valves



Specially designed lathes machine end shield recesses in each end of the frame, automatically locating from the precision-ground bore. Throughout this machining group care is taken to balance the work done at each machine, in order to avoid piling up the work at any point. All cutting tools are carbide-tipped

The New "Machine Tool Gray"

BY WENDELL E. WHIPP, PRESIDENT, THE MONARCH MACHINE TOOL COMPANY *

A STANDARD COLOR for machine tools has been adopted for some years. Adherence to the standard, however, both by makers and buyers of machine tools was a matter of preference; variations were made when either the customer or the builder so desired.

During the past few years customers have increasingly specified a color lighter than the old "machine tool gray," and there has been a tendency on the part of the machine tool builder to drift to a lighter shade. The result has been a lack of uniformity which marred the appearance of plants with machine tools bought from different builders.

The demand for lighter colors by some machine tool customers resulted in a multiplicity of standards. Meeting customers' color requirements often meant that many small parts, as well as the machine itself, had to be specially handled in the assembly department. With the advent of production for defense—now production for war—the question of color took on a new significance. The major issue became one of productivity. What color would be conducive to maximum production in manufacturers' plants? That was the all-important question.

Color Changes Cause Delay

It is the job of the machine tool builders, in this emergency, to turn out all the machine tools they can possibly build in the least possible time. Anything which interferes with this objective must go by the boards. Changing the color on one machine, or on a group of machines, inevitably means production delays. This is particularly true when the manufacturer finishes his machines with spraying lacquer. Before a color other than standard can be sprayed on a machine tool, the spraying equipment must be thoroughly cleaned; afterwards the equipment must be cleaned again and the original color put back in. For some light shades a different priming coat is required. All this takes time which simply cannot be spared under the present emergency.

Early last fall an assortment of colors was sent to all members of the National Machine Tool Builders' Association, and they were asked to make their selection. Majority opinion was in favor of a color somewhat lighter than that previously used, and at the Association's October convention, this lighter machine tool gray known as "7-B" was officially adopted. It has been accepted as standard by all divisions of General Motors and Chrysler, the Caterpillar Tractor Company and the British Purchasing Commission.

The new color standard is based on practical tests. Half of the machine tools in a large department were painted with the new light gray, the others with the former darker standard. Two-hundred-watt bulbs used over the new color gave the same light intensity as 300-watt bulbs used over the old color. With lamps of the same power this would represent a 33⅓ percent improvement in visibility.

A large machine tool looks lighter than a small one painted with the same color because of its large surfaces and because in many cases it is higher and, therefore, nearer to the light source.

This question was carefully discussed within the Association. It was believed, however, that in the interests of standardization for maximum productivity the new "7-B" shade should be universally adopted. At the same time no deadline was set for the change-over, and it was left to the discretion of each machine tool builder to make the change in whatever way suited his particular circumstances.

Advantages Outweigh Faults

There have been some objections to the new color. It shows dirt and finger prints more easily. It is harder to keep clean. No one understands these objections better than the machine tool builders themselves—for machine tools in machine tool plants are now running as nearly as possible around the clock, and the job of keeping them clean becomes increasingly difficult. Nevertheless it was felt that the advantages of the new color in better visibility outweighed the disadvantages caused by cleaning difficulties.

Also considered was the intangible factor of the attitude of the operator toward his machine. Operators take pride in a good-looking machine tool, and this pride leads to better workmanship and more output. It is the experience of shop men that operators are more likely to keep the light-colored machines wiped clean and in good order.

Following the adoption of the new color, Lowe Brothers of Dayton, Ohio, was again appointed "custodian" of the color, and furnished samples of the new color which were sent by the Association to all members. The new color is available in quick-drying spraying lacquers and also in brushing enamels. Machine tool builders have been authorized to pass on their A-1-a priorities to paint manufacturers, so that for the time being, at least, no difficulty in securing ample supplies of the new color is expected.

Suggestions for Using

Now a few practical suggestions as to cleaning methods to be employed on machine tools painted with the new color. Lowe Brothers has been conducting a series of tests on this problem in General Motors' Frigidaire plant and in our own plant here in Sidney. As a result of these tests the following recommendations are made:

An excellent cleaning agent to be used on rags for wiping machine tools clean is made up of a mixture of 25 percent light lubricating oil and 75 percent mineral spirits. The mineral spirits used can be Stoddard's solvent, which is a dry-cleaner fluid, or any other standard grade of mineral spirits with a minimum flash point of 105 F. This latter stipulation is necessary to pass the requirements of the underwriters.

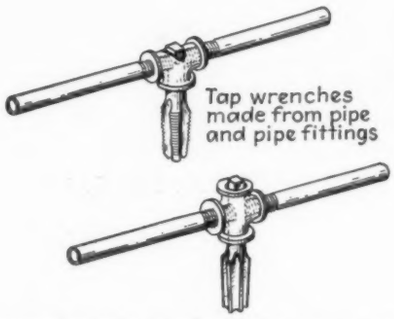
On surfaces which are subject to stain which the above mixture will not readily remove, a spot remover is suggested. Lowe Brothers, for instance, make a semi-paste spot remover for this purpose, and other manufacturers no doubt offer similar products.

As a general principle, it should be borne in mind that if the finish on a machine is pyroxylin quick-drying lacquer, the finish is more durable and will stand a stronger cleaning agent; whereas if the finish on the machine is a brushing enamel, a drastic cleaning agent may have a tendency to soften the finish.

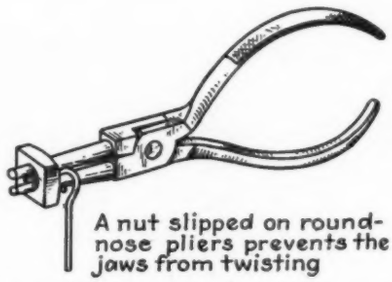
*Chairman, Color Standards Committee, National Machine Tool Builders' Association.

SHORT CUTS FOR THE SMALL SHOP

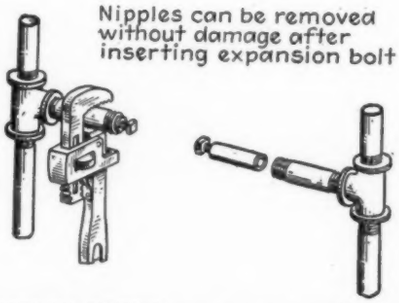
BY A. H. WAYCHOFF



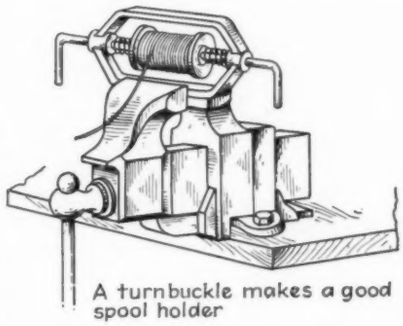
IMPROVISED WRENCHES for taps and reamers can be made from short lengths of pipe and a pipe cross. Usually, ¼-in. pipe will suffice. Cut extra long threads on one end of each pipe and screw them into the cross. The long threads enable the handles to be screwed tight against the tap or reamer after it has been inserted in the cross. Should a cross not be available, a tee can be used. Notch the top of the tee so the tap or reamer can be inserted far enough to be gripped by the handles.



BENDING WIRE with round-nose pliers has a tendency to twist the jaws out of alignment. This can be avoided by slipping a small nut over the jaws after the wire has been gripped. No matter how severe is the twisting action, the nut will retain the grip and prevent the jaws from springing.

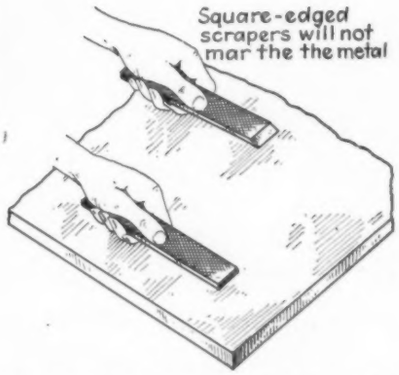


TIGHT NIPPLES can be unscrewed from pipe fittings without crushing the nipple if an anchor or expansion bolt is inserted before applying the stillson wrench. Only enough pressure need be placed on the expansion bolt to bring the two halves of the bolt snug against the pipe walls. With this solid support in the nipple, it can be turned without crushing the walls or breaking the seam no matter how tight it may be in the fitting.

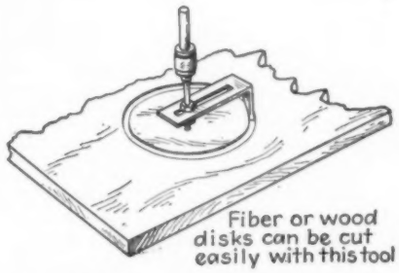


WIRE SPOOLS can be held in a turnbuckle when it is necessary to regulate tension for winding coils by hand or for using spooled wire when wrapping packages. However, the spool will not fit in the turnbuckle unless the sides are heated and bent as shown. The turnbuckle screws can be turned down and shouldered to fit the holes in the spool. Place a washer on the turned ends if the shoulders enter or cut the spool; also, small springs between the washers and the turnbuckle will maintain tension and prevent the spool from turning too freely.

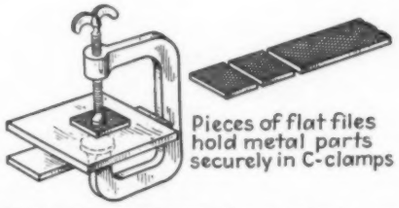
HOLDING RODS, pipe or tubing in a vise is not difficult if the following idea be used: Take a piece of rubber hose and split it lengthwise, leaving about three-quarters of the circumference. Tear off a sheet of sandpaper and place it inside the hose with the sanded surface next to the pipe or rod. When the vise is tightened, the combined action of the hose and sandpaper will be sufficient to grip the round object tight enough for cutting threads.



BEVELED SCRAPERS are not as good as ones with square edges. Yet nine of ten men who make them for scraping paint or corrosion from metal will bevel the edges similar to a wood chisel. Such a scraper will dig into the work and mar it. A square-edged scraper is easier to handle, has two cutting edges, will last longer, and will leave a clean surface free from scratches.



FIBER DISKS can be cut on the drill press with the illustrated tool. It is made from ¼-in. strap steel pointed at one end and bent at right angles. The cutting point is slightly longer than the thickness of fiber to be cut, and is upset, hardened and ground with the proper clearances. A slot cut in the horizontal leg makes it adjustable to different radii. This cutter will also work well on wood.



NON-SLIP BLOCKS for C-clamps can be made from discarded files. Break off a couple of squares from the end of flat files, and place one on each side of the metal in the clamp. As the clamp is tightened, the blocks will turn slightly on the work, holding it rigid.

Gears and Racks

COMPILED BY J. G. MAGRATH, APPLIED ENGINEERING DEPARTMENT, AIR REDUCTION COMPANY

The happy combination of a wear resistant surface and a tough core results when teeth are flame hardened. Control of distortion is another advantage

SEVERAL DIFFERENT OPINIONS prevail in the gear industry regarding the amount and contour of hardness depth required in flame-hardened teeth. One school of thought believes that superior results are obtained when the teeth are treated as in Fig. 61 *e*. The other finds best results in teeth treated as in Fig. 61 *b*. Both schools have excellent authority and have proved their claims in actual experience.

Perhaps the answer is not necessarily a compromise, but rather a suggested rule for graduating the depth of contour in direct ratio to the size of the tooth. The largest sizes, as a general rule, are of such pitch that the area of contact extends but a short distance each side of the pitch diameter. Since teeth of this size have considerable metal behind as reinforcement, it is ordinarily sufficient to harden only an area comparable to that shown at *e*. The small sizes on the other hand are generally of finer pitch and of smaller volume. Consequently they are rapid conductors of heat and lend themselves to the contours shown in Fig. 61 *a* and *b*. Details *c* and *d* portray suggested depth contour on teeth of intermediate sizes.

Wherever possible, both sides of a gear tooth should be heated and quenched simultaneously, as distortion is thereby minimized and a greater degree of depth contour uniformity obtained. A fine example of depth contour and hardness uniformity is the specimen tooth taken from an SAE gear hardened on a Gleason surface hardening machine, Fig. 62.

Twice Load-Carrying Capacity

Flame-hardened gears have a number of advantages. The most outstanding is that a flame-hardened gear tooth surface, properly treated, has nearly twice the wearing load-carrying capacity as that of an unhardened gear. It is doubly essential that flame-hardened gears be correctly aligned; otherwise the load may be concentrated either at one end of the tooth or possibly at the top of the tooth. As the hardened surfaces resist the greater wear caused by this misalignment, and as the gears are thus not permitted to "work in", early failure may result. Such failure could not be legitimately charged to flame hardening but rather to lack of care in alignment.

Gear teeth to be flame hardened can be finish machined prior to surface treatment inasmuch as accuracy is maintained during the hardening process. Heat-treatment of the core to predetermined desirable physical properties can be completed prior to flame hardening as the core is not affected by the surface treatment. The transition zone between the tooth surface and the core assures against surface spalling.

A thorough investigation of the results of varying procedures in flame hardening gear teeth was made by the metallurgical department of an eastern steel mill. Among the factors found to have important bearing upon the results are the following:

In choosing the size tip for a gear tooth, the length of the line of flames should be about equal to or a little shorter than the height of the tooth.

Since the part of the tooth ahead of the flames is heated to some extent by conduction, and the effect of this heating is greater at the finishing end than at the starting end, the travel should be compensated so that there is a gradual

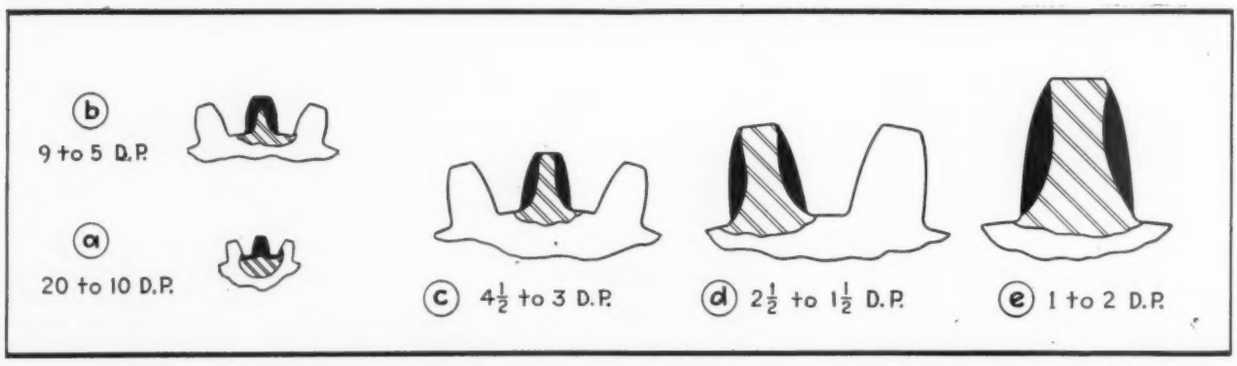


Fig. 61—*Depth and contour of hardened area are subject to differences in opinion but in general are a function of the diametral pitch*

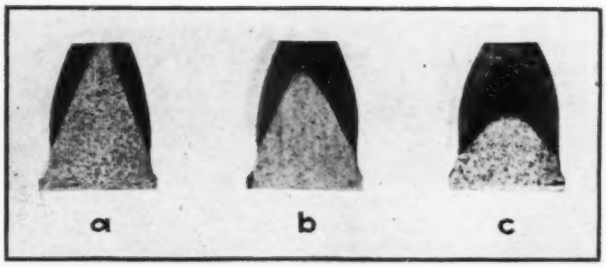
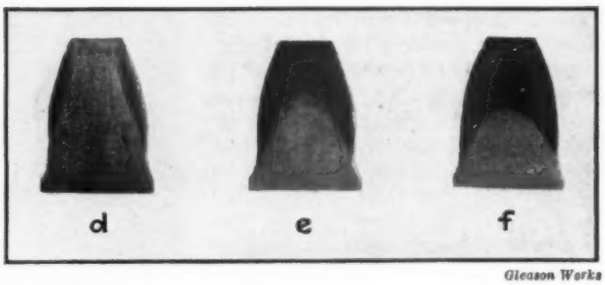


Fig. 63—*Gear tooth cross-sections are directly influenced by flame speed. See Table XVII for speed and hardness readings. Composition: 0.35 C, 0.85 Mn, 0.016 P, 0.022 S, 0.019 Si, 0.20 Ni and 0.14 Cr.*



Gleason Works

Fig. 64—*Gear teeth hardened as in Table XVIII appear as above. Composition: 0.33 C, 0.70 Mn, 0.016 P, 0.019 S, 0.22 Si, 0.25 Ni, 0.69 Cr and 0.18 mo.*

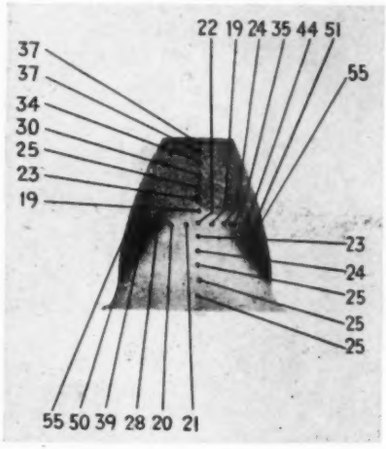


Fig. 62—*An SAE 4640 gear tooth shows the hardness graduation from surface to core. Readings are Rockwell C scale*

Table XVII—INFLUENCE OF FLAME SPEED ON HARDNESS

Tooth	Time	Side	Rockwell Hardness: Starting End	Rockwell Hardness: Finishing End
a	51 sec.	R	C 46, 49, 47, 47, 48, 48, 52, 52, 52, 54, 56, 56	
a	51 sec.	L	C 47, 47, 49, 48, 48, 49, 53, 53, 53, 55, 55, 56	
b	60 sec.	R	C 50, 52, 55, 52, 54, 54, 54, 54, 54, 55, 54, 56	
b	60 sec.	L	C 55, 51, 52, 52, 53, 52, 51, 55, 56, 56, 58, 57	
c	86 sec.	R	C 41, 52, 54, 53, 54, 54, 53, 55, 55, 55, 52, 43	
c	86 sec.	L	C 53, 53, 53, 52, 53, 52, 54, 55, 56, 50, 45, 39	

Table XVIII—INFLUENCE OF FLAME SPEED ON HARDNESS

Tooth	Time	Side	Rockwell Hardness: Starting End	Rockwell Hardness: Finishing End
d	44 sec.	R	C 57, 57, 57, 57, 57, 56, 55, 56, 56, 56, 56, 54	
d	44 sec.	L	C 55, 56, 56, 55, 56, 56, 58, 55, 56, 56, 56, 56	
e	49 sec.	R	C 46, 48, 45, 46, 48, 45, 46, 46, 47, 44, 45, 47	
e	49 sec.	L	C 46, 46, 46, 49, 46, 47, 49, 49, 49, 49, 46, 44	
f	55 sec.	R	C 45, 43, 46, 44, 44, 44, 42, 45, 46, 47, 46, 46	
f	55 sec.	L	C 44, 46, 42, 43, 47, 41, 47, 44, 46, 46, 44, 43	

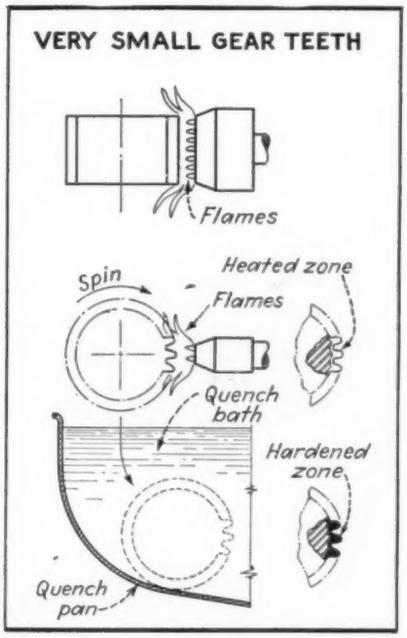


Fig. 65—*Gear teeth of 10 D.P. and smaller may be hardened by spinning the gear and dropping it with an underpan quench*

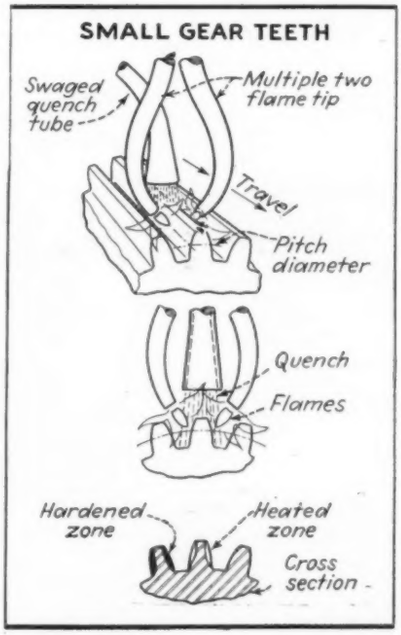


Fig. 66—*Progressive hardening works well with gears from 4½ to 9 D.P. Tip, torch and quench travel on a radiagraph*

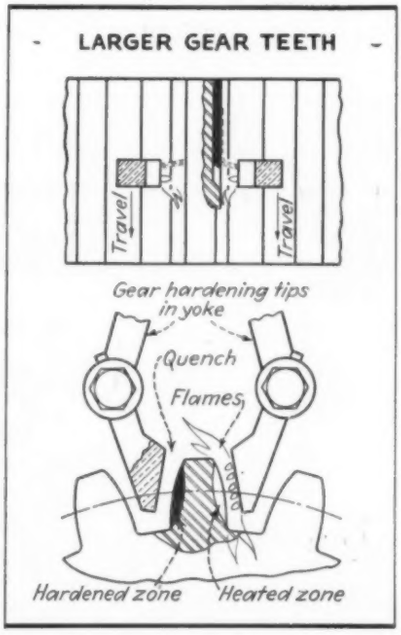


Fig. 67—*Gears 5 D.P. and larger use the progressive method with heating and quenching tips mounted on a gear-hardening yoke*

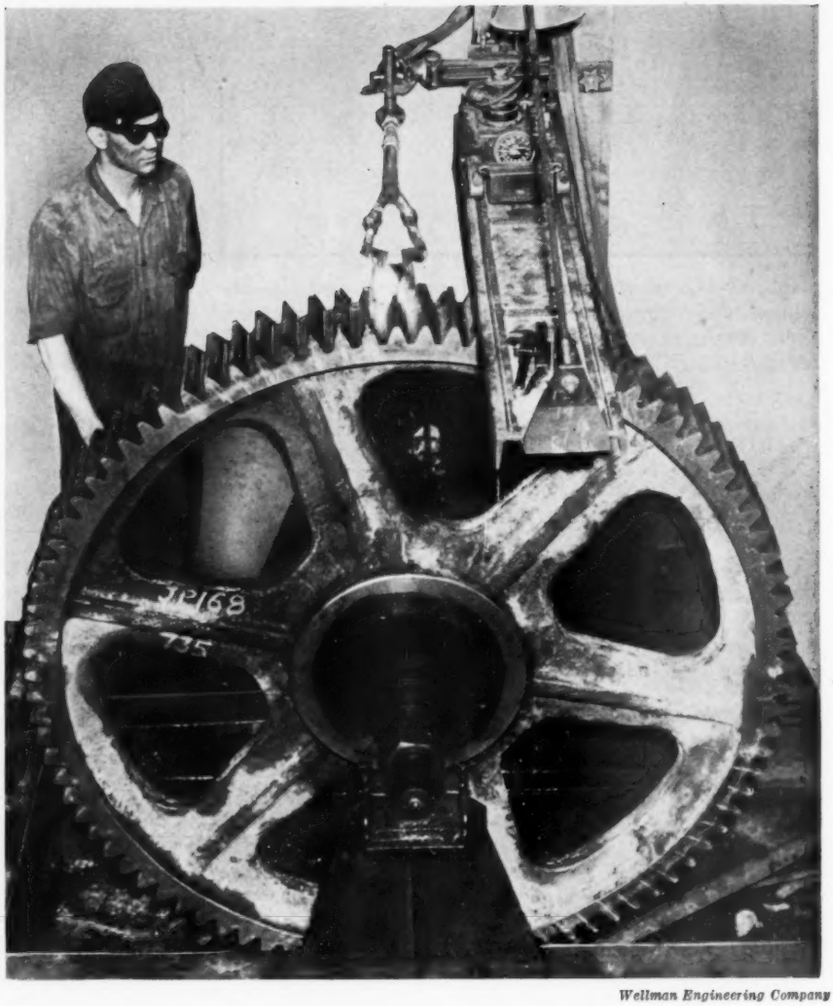
increase in speed from beginning to end of the forward stroke of the flames. It may be necessary to provide additional acceleration of the flame travel just at the end of the stroke to prevent burning the corners at the end of the tooth. Or, the flames may be arranged to spread apart at the end of the stroke.

When necessary, preheating, which generally results in increasing the depth of hardness but decreases the degree, can be accomplished by passing the flames over the tooth twice; once rapidly backward, slightly preheating the tooth, and then once forward at the prescribed speed to give the hardness depth required.

Speed Decreases Depth

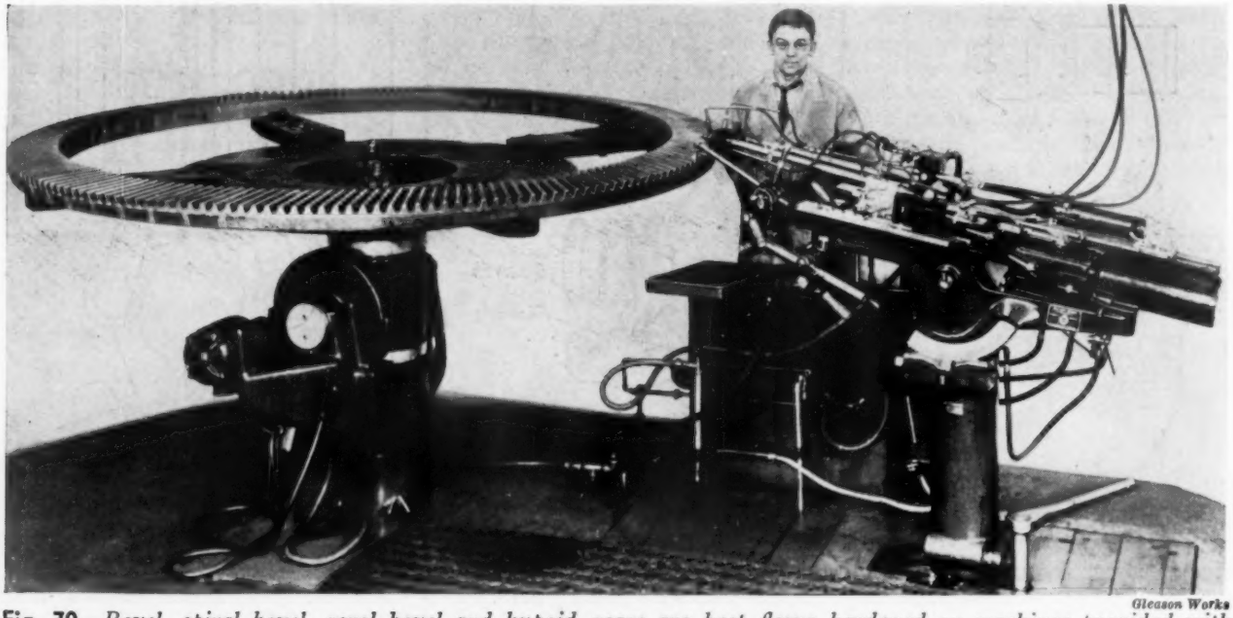
A decrease in the speed (increase in the hardening time) greatly increases the depth of hardness. This is definitely shown, Figs. 63 and 64, which illustrate specimens taken from forged and machined pinion gears having 20 2-D.P. teeth, $2\frac{1}{2}$ in. long. These teeth were flame hardened with variations introduced in the procedure. Rockwell hardness tests were made on the cut teeth along the pitch line on each side.

A greater depth of hardness on one side of the teeth than on the other results from setting the hardening tips improperly with one farther from the tooth face than the other. This variation will usually occur to a greater extent on teeth that are shallow hardened rather than in those that are deep hardened. Therefore, when shallow hardening is desirable, greater care is



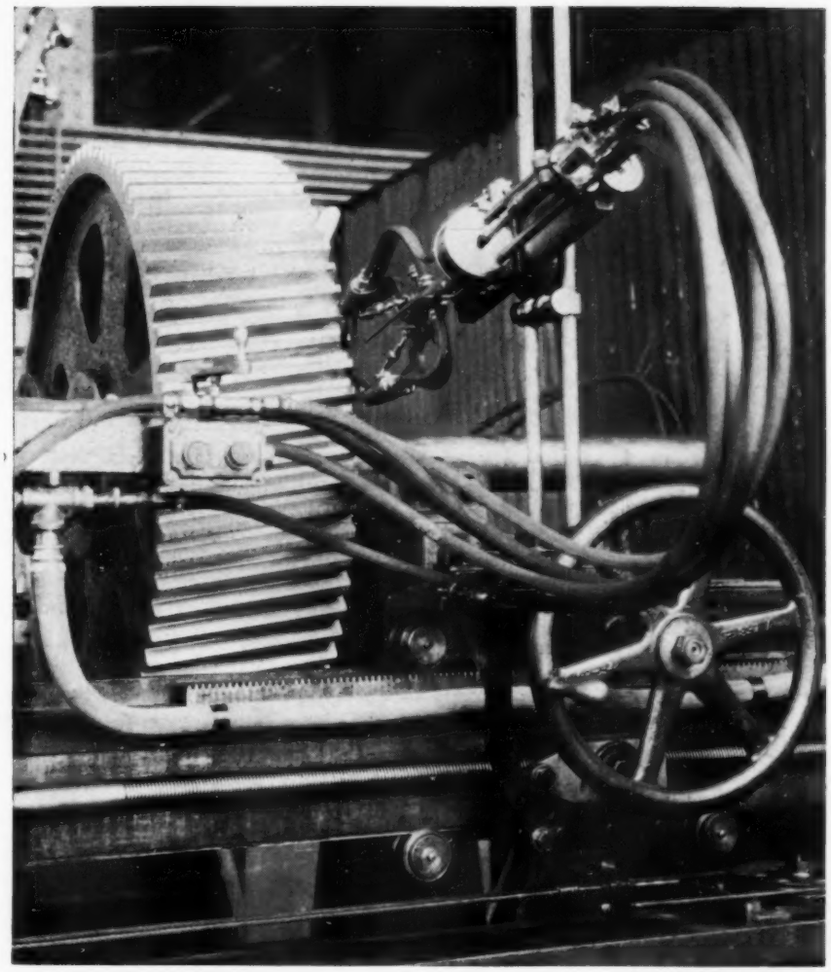
Wellman Engineering Company

Fig. 68—*Mounted on a spindle, this large spur gear is flame hardened with heating and quenching tips carried along the tooth on a radiagraph*



Gleason Works

Fig. 70—*Bevel, spiral bevel, zerol bevel and hypoid gears are best flame hardened on machines provided with automatic indexing, variable speeds and curvature cams*



Farrell-Birmingham Company

Fig. 69—*This flame-hardening unit was designed especially for treating medium and large gear teeth*

necessary in adjusting the tips at the faces of the teeth.

Very small gears, of 10 D.P. and smaller, may be flame hardened by the circular band spinning method. The flames are held sufficiently far away from the tops of the teeth so burning does not occur, and so the full tooth, top, face and root, receives the benefit of a soaking heat. Several heating tips may be spaced around the gear, depending on the particular diameter, similar to the set-up illustrated in Fig. 54 (AM—Vol. 86, page 9); quench tubes, as shown there, may be employed. Or, upon reaching the required temperature, the small gear may be released from its spindle and immediately dropped into a quench pan as in Fig. 65. The teeth will be hardened to the degree illustrated in Fig. 61 *a*.

Small gear teeth $4\frac{1}{2}$ to 9 D.P. can be progressively flame hardened as in Fig. 66. A multiple two-flame tip and swaged quench tube is employed, positioned as shown with the flame tips impinging upon the line of pitch diameter. The size of tip is determined by trial. The depth and contour of hardness may range from that shown in Fig. 61 *c* to that indicated in *b*. A broad water quench behind the flames provides flow over the top of the tooth and down both faces to the root. The flames and the quench are progressively moved along the length of the tooth at the proper speed for the required depth. Torch and quench may be mounted in a radiagraph or a gear-hardening machine.

Medium and large teeth, 4 D.P. and up, are progressively flame handened as in Fig. 67. An adjustable yoke, Fig. 24 (AM—Vol. 85, page 1088), holds and two heating and quenching gear-hardening tips in proper relation to the pitch diameter, one tip on each side of the tooth. These tips are mounted in a water-cooled torch, which is mounted on a travelling radiagraph. The flames and quench are progressively moved along the length of the tooth at the proper speed for the required depth. A typical example of this procedure is illustrated in Fig. 68. Or such gears can be mounted on machines similar to the Farrel-Birmingham flame-hardening machine in Fig. 69.

Special Machine for Bevels

Bevel, spiral bevel, zerol bevel and hypoid gears are best hardened on a flame-hardening machine similar to the Gleason machine in Fig. 70, shown treating an unusually large spiral bevel gear. Such a unit provides an automatic indexing mechanism and variable rate of tip travel to give, first, a progressively increasing or decreasing velocity to compensate for the continuous change in bevel gear tooth sections and for the heat accumulation ahead of the tips and, second, a speed-up over the ends of the teeth at the termination of the hardening stroke.

The teeth of racks, Fig. 71, may be treated similarly to the procedure described herein for the flame hardening of ordinary spur gears.

The next installment of this series will appear in an early number.

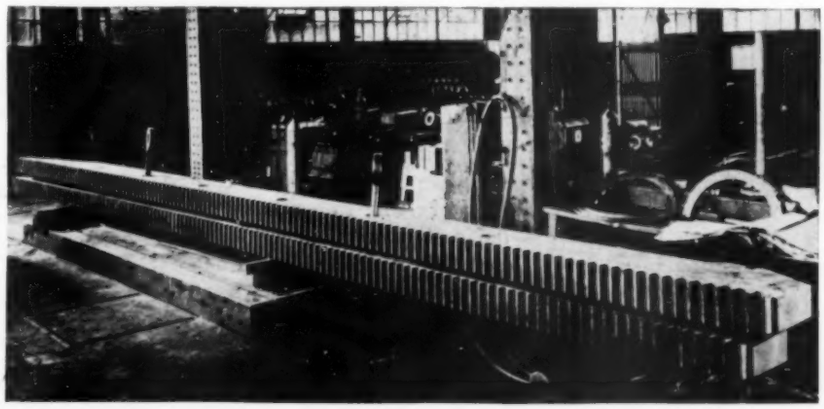


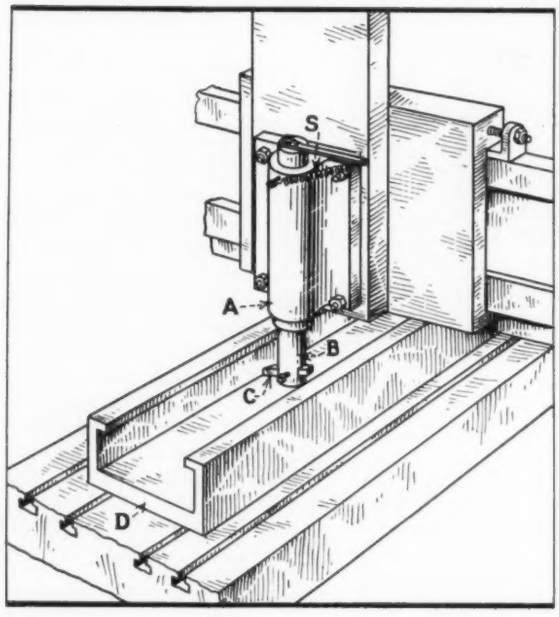
Fig. 71—*Rack teeth are flame hardened progressively and with the same procedure and apparatus employed on spur gears*

IDEAS FROM PRACTICAL MEN

Planing Tool for Undercuts

BY FRED H. COLVIN

The handling of the tool on return strokes when making undercuts on a planer is quite a problem. It was solved in one shop by the following expedient: The regular clapper box was replaced by toolholder *A* shown in the drawing. This holder carries a round bar *B*, which is held against vertical end movement by suitable collars. Planer tool *C* is held in the usual manner. Bar *B* is free to turn in *A*, and has a stop that holds the tool in the proper position for cutting.



This toolholder replaced the regular clapper box on a planer. The tool turns in the holder on each return stroke, at the end of which the spring pulls the tool back into cutting position

Spring *S* holds it against the stop, except on the return stroke.

Frictional contact between the tool and the work turns the bar enough to relieve contact with the cutting edge on the return stroke. At the end of the return stroke, where the tool clears the work, the spring snaps the tool back into position for cutting. Spring *S* has a very light tension; however, it is enough to pull the tool positively in position for the next stroke.

The adoption of this toolholder made it possible to machine the undercut on the channel section shown in half the time required by a tool mounted in the regular clapper box. The holder eliminated the necessity for raising the tool above the top surface of the channel section on every return stroke. Both the cutting tool and the stops can be reversed for planing the opposite side of the slot in the work.

Spacer Blocks Speed Valve-Gear Repairs

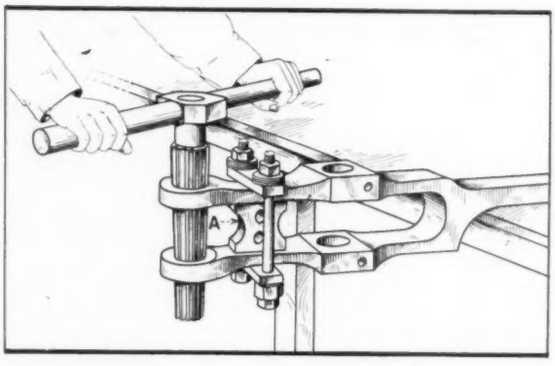
BY ARTHUR HAVENS

Many parts of locomotive valve gears such as radius bars, transmission bars, and combination levers, have long forked ends. Most of these accommodate tapered pins to support some other component part of the valve gear. When repairing these parts, it is customary to ream tapered holes and apply new pins.

Unless some means is adopted to prevent the forked ends from springing while the holes are being reamed, the finished holes will not be in alignment and the tapered pins when drawn into place will be either too long or too short. Spacer blocks, such as shown at *A* in the drawing, can be used to avoid these conditions.

A mechanic should determine the blueprint distance between the forks of the valve gear parts and make the spacer blocks to that size. Each block should be stamped with the class of locomotive and the part on which it is to be used. When a part is to be reamed or some welding done on it, the block is placed in position and clamped. Short pieces of $\frac{3}{4}$x$1\frac{1}{2}$-in. stock drilled for $\frac{5}{8}$-in. bolts make excellent straps. One set of these may be made up for each block, and if they are kept together they will save the mechanic much time each time the spacer blocks are to be used.

When the spacer blocks are clamped in place, reaming or welding can be done with complete assurance that when the radius bar or transmission bar is applied to the locomotive, the pins will fit properly.



Locomotive valve gear parts with long-forked ends should have spacer blocks between the fork when reaming tapered holes. This assures alignment when fitting tapered pins

Accurate Drill Jig for Synthane Bushings

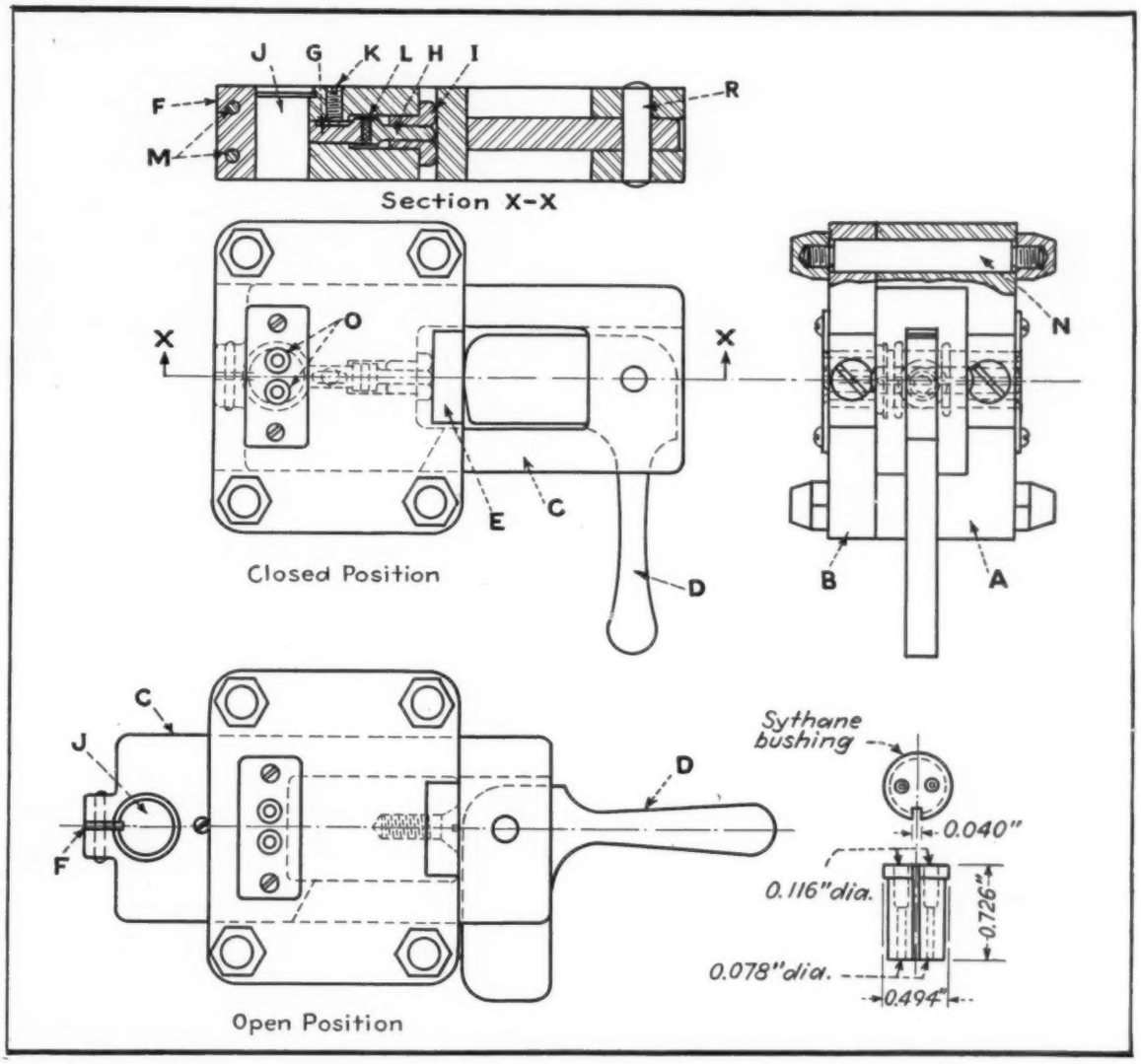
BY DANIEL I. KRAUSS

The illustrated jig was designed to drill two stepped-diameter holes in synthane bushings. The accuracy required, the nature of the chips formed, and shape of the bushing controlled the design of the jig. The essential parts are base or jig body *A*, cover plate *B*, slide *C*, cam *D*, register bar *E*, bushing key *F*, pressure pin *G*, contact pin *H*, register bushing *I*, nest *J* for the synthane bushing, and drill bushings *O*.

The heart of the jig is the slide *C*. Since the other parts of the jig body are fitted to and located from this slide, it was finished first. The end contour and opening were shaped on a band-saw. The slot for the cam *D* was milled and the hole *J* for the bushing was rough drilled following which the slide was stress annealed. After finish machining and grinding, the hole for the cam pin *R* was drilled and reamed and the hole *J* for the synthane bushing was bored, leaving 0.006 in. for grinding. The slot for key *F* was then milled, and the key fitted; it touches only the sides of the keyway in the synthane bushing, not the bottom. The holes for the pressure pin *G*, register bushing *I* and setscrew hole *K* were then finished. The slide was case hardened and the key *F* hardened and tempered.

Case-hardened slide *C* was finish ground on the four sliding surfaces to a thickness equal to the maximum length of the bushing. Bushing hole *J* was then ground to size. Pressure pin *G* was locked in place by the setscrew *K*, allowing the end of the pin to be finished to the required radius during the grinding operation. This setscrew is used in operation to prevent rotation of the pressure pin.

Rubber disk *L* was placed next to pressure pin *G* during assembly. Contact pin *H* and finally the register bushing *I* were pressed into place, retaining the assembly. Key *F* was located in the slide with two dowels *M*. Cam *D*, which locks the slide, was not



Stepped-diameter holes in synthane bushings are drilled accurately to close limits in this jig. The slide fits snugly in the body, preventing accumulation of chips in the jig

fitted until the slide and body has been assembled, at which time the proper locking position was obtained. After the cam was fitted, it was case hardened and assembled.

Body *A* and cover plate *B* were roughed out, annealed, and finish ground. Cover and body were clamped together and the holes for dowel studs *N*, which hold the assembly together, were drilled and carefully reamed. The assembled cover plate and jig body was milled for register bar *E*, which was then pressed into place and the holes in the bar transferred to the body of the cover plate, drilled and tapped. The cover was then removed and the bar screwed solidly to the jig body. The slide was placed in the groove and the register bushing lapped against it to insure positive registration.

Drill bushing holes were bored, bushings *O* pressed into place with the ends flush with the grooves. This was done to take advantage of the tendency of the chips formed when drilling synthane to load the flutes of the drill and thus be carried through the bushing, preventing the accumulation of chips in the jig. Chips which remain in the jig are carried out with the slide and removed with the bushing, this being due to the close fit between the slide and assembled jig.

The operation of the jig is as follows: In the open position, the bushing to be drilled is pushed into the slide, with key *F* registering with the keyway until the shoulder of the bushing limits the travel. The key is beveled at its upper end to aid in loading. Pressure pin *G* is also beveled along its upper edge to prevent the bushing catching on the pin. Also, the bushing will extend a slight amount below the slide due to the depth of the counterbore. To force the bushing into its proper place, the leading edge of the slide groove is beveled slightly. The slide is then moved to its closed position and locked by the cam.

When register bushing *F* is $\frac{1}{16}$ in. from register bar *E*, contact pin *H* bears against register bar *E* and is forced into the slide until the jig is closed. This movement of the pin compresses rubber disk *L* which in turn exerts pressure upon pressure pin *G*, contacting the bushing and locking it in place. This assures positive registry between the bushing and the bar, regardless of variation in bushing dimensions.

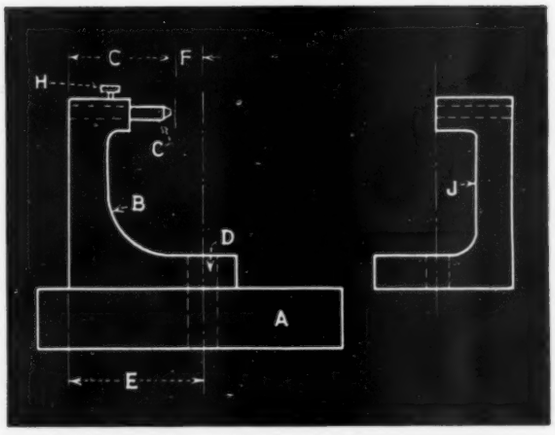
The large holes in the synthane bushing are drilled first to a predetermined depth, after which the jig is turned over and the small holes drilled, allowing the drill to break into the large holes. The cam is then unlocked and the slide pushed forward, the bushing being removed at the completion of the cycle.

Shop-made Radius Dresser for Grinding Wheels

BY CARL NEUBERT

The radius grinding wheel dresser shown in the drawing can be made quickly and inexpensively in any small shop. It has four basic parts: base *A*, arm *B*, diamond *C* and dowel pin *D*. With the parts assembled, the dresser swivels about dowel pin *D*.

The base and arm are made of cast iron, and the



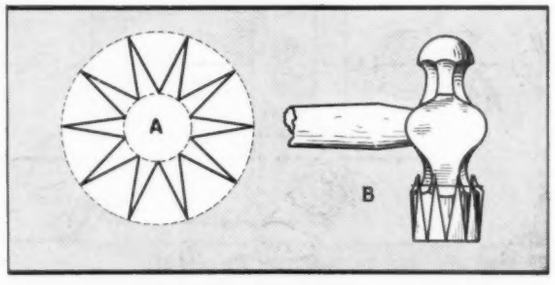
These swiveling arms with adjustable diamond can be made in any small shop for dressing convex and concave grinding wheels

mating faces must be square. It is important that the back of the arm be exactly perpendicular to the top of base *A*. The most important dimension of the dresser is *E* which can be 2, 3, or 4 in. depending upon the size of the wheel to be dressed. When setting the dresser, the radius *F* will be known. This radius, subtracted from dimension *E*, will give dimension *C*, the location of the diamond which can be set with a micrometer. The diamond holder can be tightened in position with setscrew *H*. The diamond can then be centered with the grinding wheel, and the latter dressed to the desired radius, making the finished cut a very light one. The arm *J* was designed for dressing concave wheels.

Copper Sheets for Making Soft Hammers

BY C. F. FITZ

Every mechanic has use at some time or other for a soft hammer, and when he does one cannot always be found. We have overcome this by making stars *A* from sheet copper. These are placed over the face of regular ballpeen hammers as shown at *B*, and fastened with wire. This expedient saves time when a machinist needs a soft hammer. The copper stars are cheaper to make than regular soft hammers, which is an additional incentive for using them.



Stars punched from sheet copper can be bent around a machinist's hammer, converting it into a soft hammer

War products are no novelty to auto workers; these Cadillac machinists are working on aircraft engine parts

Motor Cars to Munitions

By BURNHAM FINNEY, EDITOR, *AMERICAN MACHINIST*

Sedans yesterday, tanks today—now it's up to the automobile industry to demonstrate just how convertible it really is

THE AUTOMOBILE INDUSTRY is the first of America's great peacetime manufacturing industries to be chosen for 100 percent conversion to war production. Motor car assemblies for the civilian market have been cut off by the government to permit the industry to give its undivided attention to intensifying the Battle of Production to win this Second World War. Over nine billion dollars worth of Army and Navy orders are being poured into Detroit. And that is only a starter.

How long will this conversion process take? When can the country expect a huge volume of munitions to come off automotive production lines? To what extent can the industry use the machinery now in its factories? What of the way in which the industry is going at the most important assignment in its history?

The first thing to realize is that the retooling of automobile factories for defense production began long before Pearl Harbor. It got going back in 1940 and progressed steadily during 1941. By the time of the Japanese attack, the industry was turning out a substantial volume of war goods. It was not until after Pearl Harbor, how-

ever, that an all-out war effort started, and car manufacturers entered upon the gigantic task of retooling all of their equipment and facilities for war.

Automobile men dislike the term "conversion." They are accustomed to the phrase "tooling up." Tooling up is part of their regular business. It means a rearrangement of production lines, the adaptation of as many existing machines as possible to new operations and the installation of a considerable amount of new machines specially designed for specific jobs. The process involves the ordering of new machine tools, of new jigs and fixtures with which to hold the work in place on the machine tools, and of new cutting tools which are used on machine tools to do the actual cutting of the metal. It is a time-consuming procedure, which runs over a considerable period, even with three shifts and overtime.

This line, set up for generator armatures, is now busy on aircraft starting motor coils

Model Changes Overshadowed

Retooling of automotive plants for munitions manufacture involves much more work than retooling for new car models. When the industry goes over from one model to another, it still is producing essentially the same article. When it transfers from cars to tanks and guns and airplanes, it is taking on products which differ radically in size, design and manufacturing technique from motor cars.

It is impossible to lay down a rule that any fixed percentage of existing automotive equipment can be retooled for munitions work. The percentage varies with each item. Huge presses which stamp out entire steel body tops are ill-adapted to war use. One of the most difficult problems to be solved is what to do with the industry's press shops. The war calls for fewer pieces of big sheet steel than of almost any other item.

Cast iron foundries likewise are not much needed. Car assembly plants, of which the industry has many, also are of little help. They consist mostly of spray booths, paint ovens, welding and assembly fixtures and of special conveyors. Only the actual floor space is of wartime value.

Fewer machines in automotive factories can be retooled for aircraft engine manufacture than for almost any war product. That is because of the large size of the individual parts compared with an automobile engine and of the extremely close production tolerances.

Let's get down to cases. Chrysler needs 2,200 machine tools to make the Bofors anti-aircraft gun. Of that number 600 are being taken from existing Chrysler equipment. When Chrysler first erected its tank arsenal, it bought all new machinery because that was what the government wanted. In the enlargement of the tank program, however, 800 of the 2,300 machines required are to be taken from Chrysler plants. Almost all the machinery for production of small-sized shell and projectiles will consist of retooled Chrysler units.

The only thing that General Motors had to buy new for Army truck manufacture was some machinery for the universal joints on the front-wheel drive and a transfer case. Practically no new equipment was required for small ammunition production, because existing screw machines could be retooled. When it comes to large items of ammunition, all new equipment must be secured. Armored cars, tanks and airplane engines get into a range of machinery beyond the sizes usually found in the automobile industry. The kind of equipment that General Motors has in surplus is the kind that nearly everybody has. It is the machinery for making the smaller munitions items.

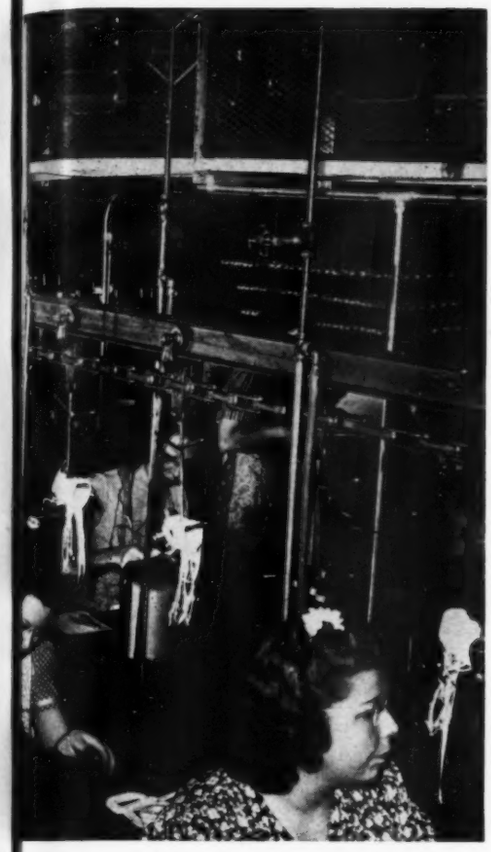
General Motors will build aviation engines at a plant in the East which heretofore has produced passenger cars. A total of 3,110 machine tools was needed. Only 900 machines suitable for retooling for this job were available throughout the entire corporation. The remainder had to be obtained from machine tool builders. By contrast, as in Chrysler's case, when some 163 machine tools were required to manufacture a certain large ammunition item, eighty, or one-half, were found in the corporation's regular equipment and are being retooled for the new work.

Two Ways to Tool Up

There are two ways of tooling up for the manufacture of munitions. One is to try to do the best with the equipment on hand, on the basis that limited immediate output justifies improvised methods. That is what England's automobile industry did after Dunkirk. Used by itself, this policy could cost the United Nations the war.

The other extreme is to start from scratch and build a plant with machinery designed to attain the highest possible rate of production. The automobile industry has employed both ways separately and in combination. Today the emphasis is on a mixture of the two.

Contrary to the common impression, automobile companies have constructed few new plants for war work, using existing facilities instead. Most of the new facilities are in the aircraft field, particularly in aircraft engines. One of the most spectacular projects is Ford's bomber plant which will be the biggest



aircraft factory in the world. It won't be fully ready for a number of months but as one department after another is completed and machines installed, parts manufacture begins.

Outside the aircraft field, the automobile industry's outstanding job thus far is Chrysler's construction and operation of the first mass-production tank arsenal in the world. Heretofore tanks had been built on a job-shop (mostly handwork) basis. At Chrysler they were to be made and assembled like automobiles. That plant today is running like clockwork. It takes somewhat longer to erect, equip and get into production a new munitions factory compared with retooling existing facilities. But on one score we should thank our stars: every brand-new plant that we now have or that soon will be operating is adding just that much to the capacity needed to win the war.

Peacetime Peak Passed

General Motors has committed itself to produce war materials at an annual rate when operating at capacity of $3,104,000,000 (much higher than its peak peacetime rate), involving hundreds of different items ranging from small cartridge cases to complete tanks. In only one instance is the government setting up complete new building facilities for these projects. In three other cases Uncle Sam is providing part of the facilities of a type not available within the corporation, and General Motors is supplying the balance. On all other items, all of the building facilities are being changed over from motor car production.

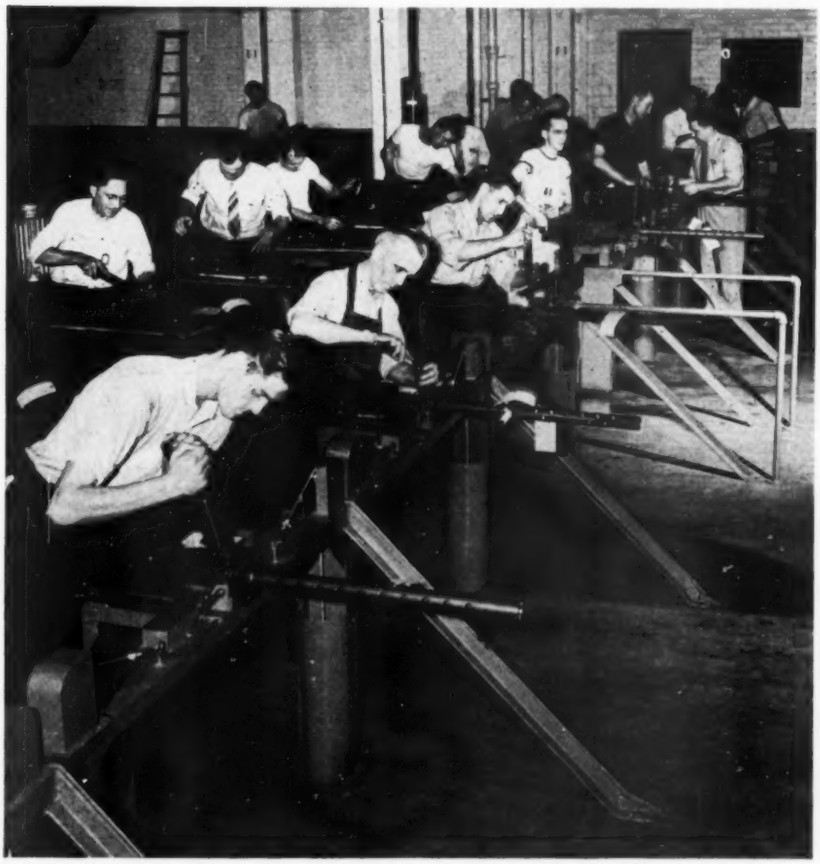
Ford is a good example. With 100 new tools it is making airplane parts in one of its automotive factory buildings. Presses normally employed for making plastic products are being used to manufacture tank parts. Tank parts, in fact, will be fabricated at many spots. Complete tanks will be assembled in an existing structure. "Jeeps" are being assembled at several plants. Truck engines, jeep engines, bomber parts and tank parts are all being produced in one building, illustrating the diversified use of present facilities.

Automobile makers have been roundly berated for having continued "business as usual" during the model year 1941 instead of converting their facilities more rapidly to war work. They say, however, that fundamental responsibility for not having curtailed car production rests upon the government. It was the only agency that could so rule. Anyway curtailment would not have brought defense manufacture until the orders were ready to be handed out in Washington. Unemployed men would have drifted away. "Conversion" would have dawdled until the specifications of the job were known. A competitive group of manufacturers, with stockholders to answer to, and lacking any full-scale military orders, could hardly have been expected to go voluntarily to Washington and say, "Please Mr. OPM, won't you order us to reduce our car-making activities? We want to produce munitions and not passenger cars."

Public Not Prepared

Even if such action were taken, the country would not have been prepared for it in the early months of 1941. The administration was being denounced for war-mongering, the America First Committee was whipping up sentiment for isolationism and automobile manufacturers risked being branded as "merchants of death."

Nevertheless a few "insiders" confess their belief that automobile companies missed a golden opportunity to prove the responsibility of private enterprise to the nation when they rode



Final adjustments on machine guns typify the major adjustment the industry must make before it is on an all-out basis

the boom in car sales instead of putting on brakes to clear the way more quickly for defense production. On December 23, 1940, K. T. Keller, president of Chrysler Corporation, said, "Looking forward to 1941, we must expect production of defense materials will quite likely affect the volume of new passenger cars and truck production for domestic use." Aside from this lone reference to possible curtailment, the industry maintained strict silence on the subject.

There is another point to which automobile makers refer. The government took pains back in 1940 to emphasize that the defense program would be superimposed on normal business. We were to have butter and guns, not just guns. The government lent its backing to this movement which culminated in the consumer buying boom in '41. It was Uncle Sam as well as private industry that was reluctant to make the decision to switch over to a complete war economy.

No Orders Refused

Every automobile company will tell you that it has willingly accepted every defense order offered it. Automotive executives say further that they have bid on business which has been given to others and have met with costly delays in getting many of the contracts now on their books. Chrysler received educational orders for ordnance items in May, 1940. Upon their completion it attempted to secure regular production orders, but did not succeed for months. General Motors volunteered to build tanks more than a year ago and was turned down because funds were not then available. Ford expressed a desire to build complete bombers months before the government awarded it a contract.

It wasn't many months ago that the politicians woke up to the fact that a large portion of defense work was going to a relatively few big corporations. A hue and cry was raised against this practice. At that time Charles E. Wilson, president of General Motors Corporation, publicly stated that his company had not been awarded munitions contracts commensurate with its capacity to handle them. It wasn't popular in Louisiana and Alabama and Mississippi for the colossus up in Detroit to walk off with big contracts while small local folks had a hard time getting a lick of defense work. Automobile executives exclaim despairingly, "We're damned because we didn't take more defense work, yet six months ago we were damned because we had gotten too much."

No story of the automotive industry's program would be complete without reference to the Reuther Plan. The plan essentially consisted of suspending the rules of competitive business and pooling the industry's resources of engineering skill and of machinery. The whole program would be directed by a joint committee of management, labor and management. Stripped of its details, the Reuther Plan is a bid for labor participation in management.

Dual Management Out

After much fireworks at Washington, Donald Nelson resolved the heated controversy between the automobile manufacturers and the United Automobile Workers by appointing Ernst Kanzler as administrator for the industry, thus ditching the labor-management scheme for the present. Many of the details for pooling machinery and other resources, suggested by the Reuther Plan, have recently been adopted by the manufacturers acting on their own. They hope thus to speed retooling and keep the demand on the machine tool industry as light as possible.

Late in 1942 the automotive industry will get close to its goal of maximum all-out war production. It will employ at the peak more people by far than it ever has in its history. And it is no idle bit of optimism to predict that the flow of war goods from motor car factories to American forces and to the United Nations will amaze the world. Every maker in the industry will do his part—Willys as well as General Motors, Studebaker as well as Ford, Hudson as well as Chrysler, not to mention Nash, a long row of truck manufacturers and a large group of parts and accessories producers.

Schedules May Be Bettered

But we don't have to wait for months to secure beneficial results from automotive companies. Past performance indicates that they will be beating time schedules by healthy margins. Chrysler is today seven months in advance of its promised delivery dates on tanks. General Motors has turned out twice as many machine guns as its contract called for in the specified time. And so it goes with other items too. Production of new war products in the automobile industry will be starting week by week as the year progresses. The volume will be mounting steadily month by month from now on. One automobile company alone is pledged to make war goods this year valued in excess of two billion dollars. There is every reason to believe that it will keep its word and perhaps go beyond the mark set.

Top automotive men see no reason for what they term "socialization of the industry" to get the job at hand done. They believe that they can do the best job by handling the munitions-making program under government direction in their own way. They have set up their own plan for pooling equipment and for leasing machinery from one company to another when war interests are served by such action. The industry is of the opinion that "socialization" will slow production down by substituting debates and majority votes for definite instructions.

On one point there is no room for argument. Automobile companies are doing all in their power to get into war production as quickly as possible. To clinch that point, one need only take into account unadulterated selfishness (and it is fair to assume that the average automobile maker is just as patriotic as the average citizen).

Full Blast on Munitions

The government has told motor car companies that they can make only guns and planes and tanks and other war weapons. The executives of those companies are responsible to boards of directors, to stockholders and to hundreds of thousands of workers regularly employed. Factories filled with expensive idle machinery earn no income. They don't even pay the interest on investments. The quicker they are transformed into fully-operated munitions plants, the sooner they will begin to be productive again for the owners. You can bet that every automotive management will move heaven and earth to see that its plants are running full blast on munitions without delay. Plain horse sense dictates such a policy.

Another point seems clear. What is needed above everything else is speed in production. Wars were never won by committees, but by commanding officers with full authority. The committee system hasn't worked so well in Washington. Mr. Knudsen-Hillman may have been acceptable before Pearl Harbor, but in war days a Donald Nelson, whose word is law, becomes necessary.

The best thing to do now is to hold automotive management responsible for turning out the required munitions in the fastest time, but let it do the job in its own way. It has accomplished miracles in mass production before. It can do it again, in munitions as well as in automobiles. It knows all the tricks of the trade. Whatever we do, let's not bind automotive management to an experimental procedure at a time when the best course to get results are clear to it. No one knows better the art of tooling or will do a better job of producing munitions, given the requisite time and barring interference.

Armament

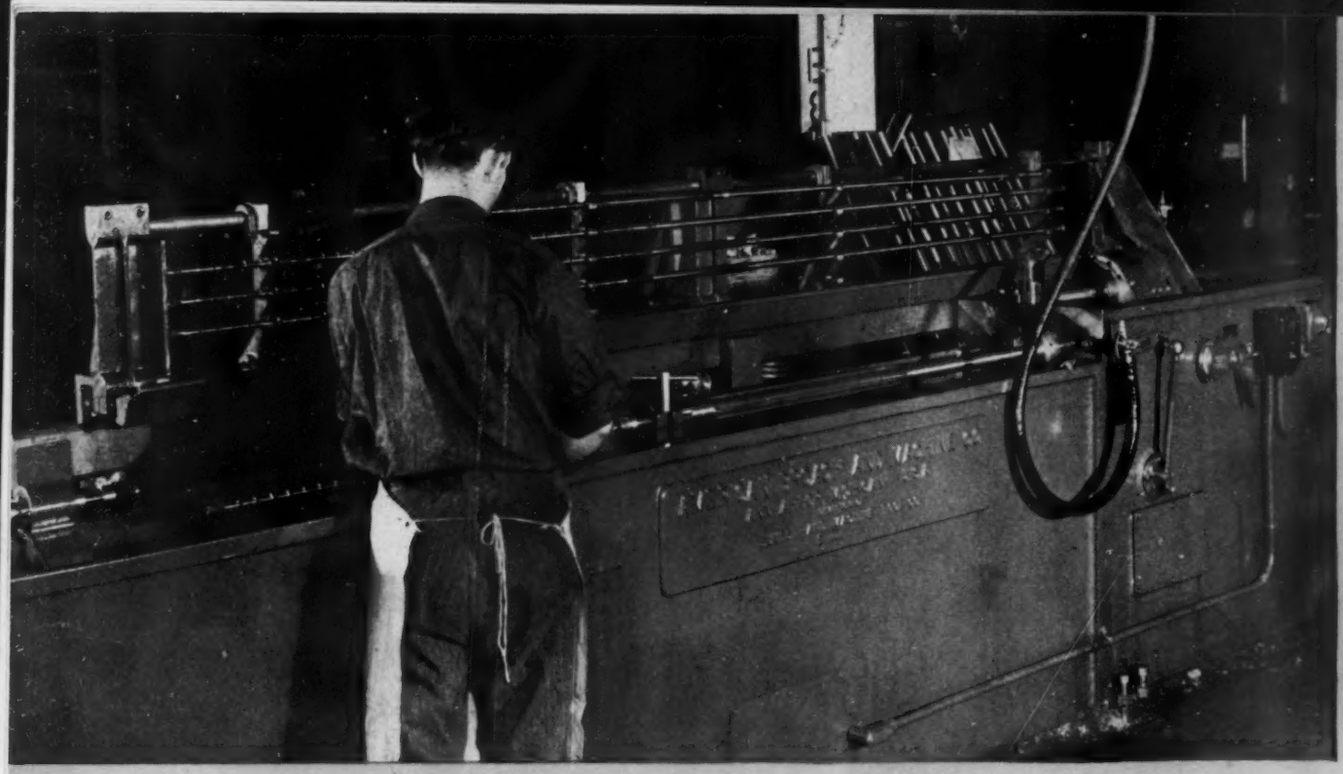
SECTION OF AMERICAN MACHINIST

Honing the breech-block hole in the breech casing is done on a Barnes Drill Company machine. The hone must be kept to size at the front end since it works to a shoulder

WAR FINDS THE Pontiac Motor Division of General Motors well started on the production of assembled 20-mm. Oerlikon anti-aircraft guns for the Navy. At the end of May, the division's Defense Plant No. 4 possessed relatively few machine tools, mostly suitable machines which could be located in the automotive manufacturing departments. During intervening months Pontiac has installed hundreds of new machine tools in a plant that will eventually employ 5,000 men.

Pontiac has subcontracted 175 out of 195 parts for the weapon, but elected to manufacture the remaining 20 more difficult pieces. These include the gun barrel and breech mechanism, which account for 45 percent of the value of the gun because of the large number of tedious operations which must be performed on nearly every piece. The breech casing, an extreme example of complexity, requires some 250 operations. Obviously few suppliers would have over 100 specialized machine tools to handle the production of this piece, to say nothing of the inadvisability of splitting off the making of one vital component from others that must be produced in close relationship.

The gun parts manufactured by Pontiac involve an enormous amount of milling. Perhaps 90 percent of the operations include milling, and of these three-quarters are form milling. Many of the set-ups on Oerlikon gun parts are not remarkable, except as they



Pull broaching the rifling grooves is performed with four broaches having integral broach buttons. Developed for 20-mm. and larger cannon bores, the American Broach Company method involves a pulling head by which the tool is caused to follow a definite helical path under the guidance of a splined master bar

Four broaches are required to rifle the 20-mm. barrel. Broaches Nos. 1 to 3 cut increasingly greater widths of groove, while Broach No. 4 finishes the sides and bottom of the groove. Each broach cuts all nine splines at once.

form a picture of high-class fixtures and modern machine tools. Milling to close limits is not the primary skill of automotive labor and young men drawn from farming communities. Dial indicators have been applied to table movements to assist the operator in milling to size and avoid over-running the cut. But tedious operations take their toll in momentary inattention and resulting scrap losses. As a consequence, Pontiac is equipping knee-type millers and other equipment as rapidly as possible with duplicating attachments.

In a contract of the magnitude handled at Pontiac's Defense Plant No. 4, processing methods are subject to constant change to speed output and improve quality. There has been no hesitancy to depart from so-called conventional methods.

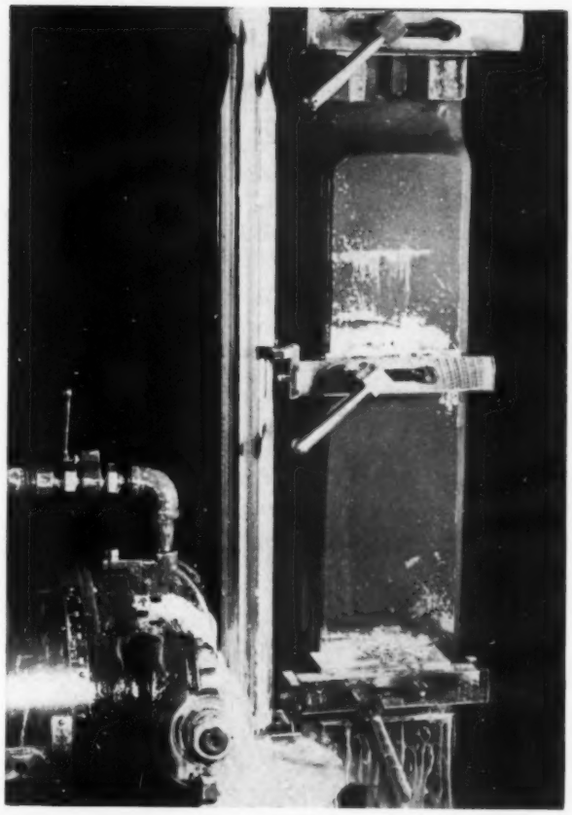
Barrel manufacture is no problem at Pontiac. The original method was laid out to include eight straightening operations at strategic points in the sequence. But to avoid corrective operations, such as straightening, and to produce a barrel with inherently better service characteristics, the experience of producing millions of automobile crankshafts has been turned to good account. The forge shop is instructed to stress relieve the barrel forgings for five hours at 950 F., and to hot straighten the forgings. These two precautions minimize residual stresses in the barrel forging, which would cause bowing during machining and heat warpage in service firing.

As a result of these practices, fewer than ten percent of barrels need be straightened after removing $\frac{1}{4}$ in. of stock per side in a single rough cut on LoSwing lathes; this percentage of barrels does not have a runout exceeding 0.005 in. Even hobbing the longitudinal cooling fins rarely causes distortion that requires straightening, and thereafter straightening is never needed.

In setting up methods to machine the 20-mm.

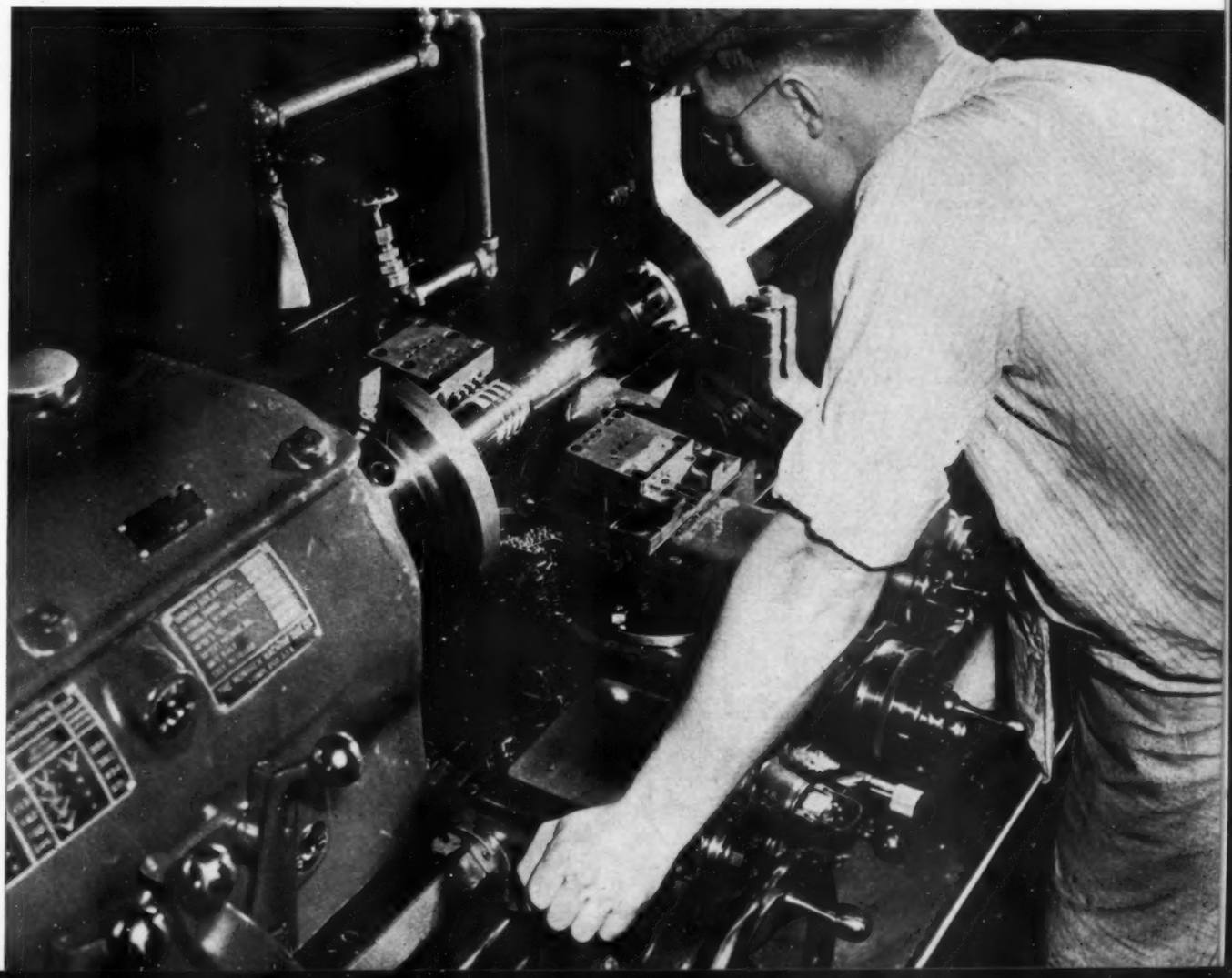
AUTOMOTIVE METHODS ON OERLIKON GUNS

Oerlikon barrel, Pontiac did not follow either the small-arms or ordnance methods for machining the bore. In the small-arms method, usual practice is to gun drill, ream, hone and rifle; in ordnance plants, to drill, rough and finish pack bore, hone and push broach with disk cutters. Pontiac gun drills on conventional Pratt & Whitney two-station gun drills, rough and semi-finish reams on special Flannery Bolt Company vertical multiple-station reaming machines, finish reams on Pratt & Whitney pull-type reaming machines, and pull broaches on American Broach Company machines, using four multiple-button broaches in sequence. Pull broaching requires 10 min. per barrel, as compared with 3½ hr. for two barrels



Eight longitudinal grooves approximately 27 in. long are hobbed on the Oerlikon barrel to produce cooling fins. Hobbing distributes the cut around the barrel, thereby avoiding distortion. Conventional hobbing was unsatisfactory, but climb hobbing gives good tool life

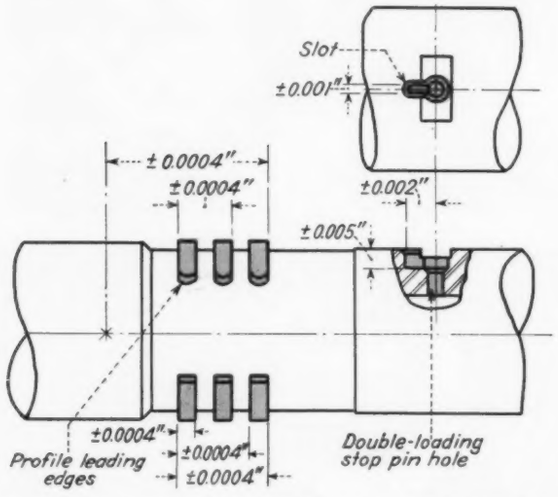
Locking grooves on the barrel are machined on a Monarch lathe in a set-up approximating piston-grooving practice, with the exception that limits are much closer



on conventional equipment using single-point rifling tools.

Chambering is currently done on a Warner & Swasey turret lathe fitted with a special fixture passing through the headstock bore and holding the barrel at either end in chucks. This set-up will be changed for increased production to a Kreuger multiple-station semi-automatic chambering machine such as employed at AC Spark Plug.

While most of the operations on the Oerlikon barrel are done in a familiar manner, there are certain set-ups which display the automotive technique in tooling up. The eight cooling fins in the barrel were originally cut one at a time on a horizontal milling machine. But distortion arises in milling from removing material from one side of the barrel at a time, while hobbing distributes the cut around the outside diameter of the barrel. Moreover, only one groove was obtained per cutter grind, causing much lost time for cutter changes and tying up numerous milling machines and cutters on one operation. The method was changed to climb hobbing on a vertical Cleveland hobber. There is no distortion of the barrel, even though the cut starts at the weakest portion of the piece. At each location of the hob, one barrel is grooved complete, after which the hob is shifted 0.200 in. laterally for the next piece. Fourteen barrels are obtained per hob grind. Tool changes are so minimized in relation to the time of cutting that one operator can handle three hobbers certainly, and perhaps four. Floor-to-floor time is one hour and ten minutes per barrel.



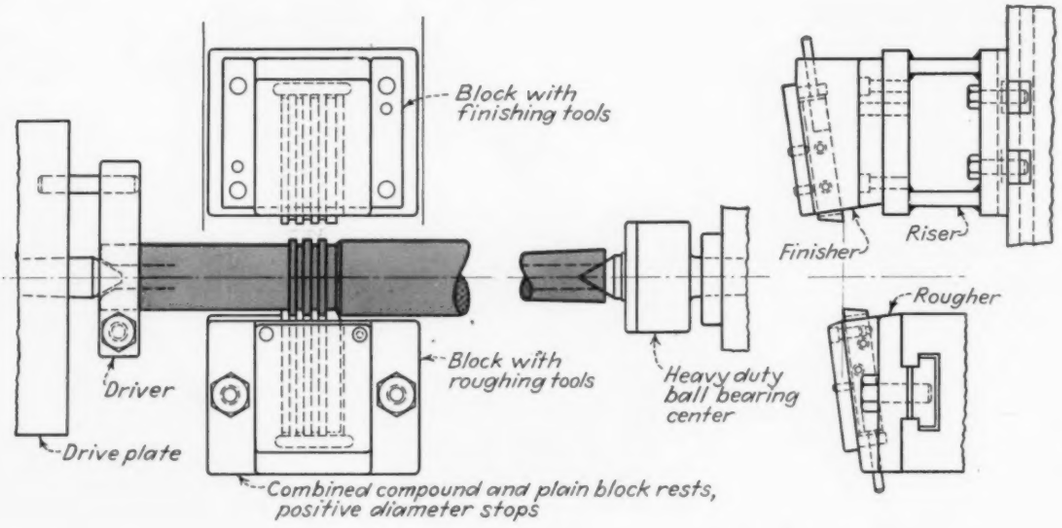
Spacing Tolerances for Locking Grooves and Stop Pin Hole

Locking Grooves Interchangeable

Perhaps the most outstanding operation at the Pontiac Defense Plant No. 4 is that of turning the locking grooves on the breech end of the barrel. Each Oerlikon gun is supplied with two interchangeable barrels which must lock properly in the breech casing. Each of the three locking grooves is held to a total limit of 0.0008 in. in spacing, the cumulative limit over all three grooves is 0.0008 in., and the over-

Limits of 0.0008 in. for spacing, and cumulative error over three grooves limited to 0.0008 in., required the development of production equipment capable of working to gage accuracy

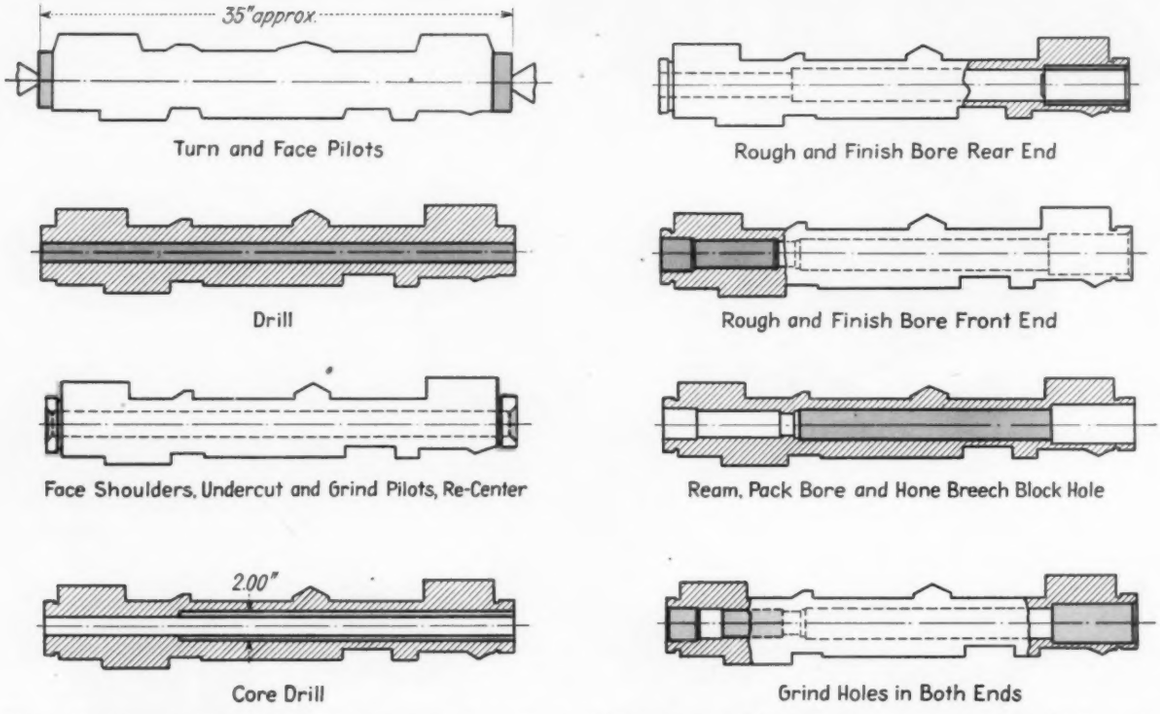
Blade-type grooving tools and spacers are lapped to 0.00005 in. for width before assembly in the front and rear toolblocks. The special cross-slide is fed to positive stops



Leading, or engaging edges, of the interrupted barrel-locking thread are profiled with a special Flannery Bolt Company machine employing an engraving cutter

A slot leading into the double-loading stop pin hole is milled on a Bridgeport machine taken from the auto plant

Three tapers at the muzzle end of the Oerlikon barrel are ground with a wide wheel on a Landis machine. The wheel is formed to finish two radii as well as the tapers, thereby avoiding laborious hand work


35"approx.
Turn and Face Pilots
Rough and Finish Bore Rear End
Drill
Rough and Finish Bore Front End
Face Shoulders, Undercut and Grind Pilots, Re-Center
Ream, Pack Bore and Hone Breech Block Hole
2.00"
Core Drill
Grind Holes in Both Ends

Since the breech-block hole at the central portion of the bore is "blind", the processing methods must be such as to secure close limits on concentricity and runout. Bottom of the breech-block hole is approximately 25 in. inside the part but runout is held to 0.0025 in.

all distance between a reference dimension and the outer groove is held to 0.0008 in. Actually, the shop holds production pieces for all of these critical dimensions to a 0.0004-in. limit.

Work in tenths requires extreme care in the manufacture of tools and a proper machine set-up. The operation is carried out in a Monarch 16×78-in. lathe equipped with special cross-slide which mounts front and rear tool-blocks and feeds to positive stops. Tools are tightly fitted into these blocks with hardened spacers. In effect, the set-up is akin to a piston-grooving operation, except that the tolerances are much closer.

The grooving tools are purchased 0.001 in. oversize for width and are lapped in the Pontiac toolroom to half a tenth. The greatest care must be exercised in making these tools to maintain size and clearance angles, and to obtain keen edges free from minute nicks. Tool angles are: front clearance, 5 deg.; side clearance, 1 deg.; plus a $\frac{1}{32}$-in. top land. Tools are checked with a master gage to a 0.0002-in. limit for spacing and cumulative error.

It has been found best to mill the interruptions in the locking grooves prior to turning the grooves. This practice avoids throwing up a heavy burr between the grooves, as would be the case if the interruptions were milled after grooving. Besides, when turning the grooves, the chip is no longer than the length of the groove and cannot carry around with the work.

Leading edges of the locking grooves on the barrel must be radiused to promote ready engagement with the locking grooves in the breech casing. Hand filing is a tedious operation, and is now largely avoided by the use of a special machine built for the purpose by the Flannery Bolt Company. A power-driven spindle is caused to swing by hand around a post or column, and the modified engraving cutter profiles the radius on the leading edge of the groove. The burr thrown up by the cutter is quickly removed by a minimum of hand filing and polishing. This method of profiling the radius has cut the labor requirements from three to four bench hands to a part-time job for one man and has improved quality.

Many Milling Operations

Milling the slot leading into the double-loading stop-pin hole is indicative of the tedious, small milling operations frequently found in gun work. Rather than to set up this operation on an expensive milling machine, the job is applied to a Bridgeport miller. After milling the slot to the limits shown on an accompanying sketch, the operator exchanges cutters for milling the 45-deg. chamfer around the slot. The hole has previously been drilled, reamed and counterbored on a No. 2B Edlund drill press.

Grinding is employed to finish the three tapers at the muzzle end of the barrel and radius the outer tapers to adjoining straight surfaces. This method is much faster than finish turning and hand finishing the radii. A Landis cylindrical grinder is used for the purpose, a wide formed wheel being employed. After dressing the wheel with the special attachment provided, the operator grinds the 30-deg. taper near the cooling fins, the taper near the muzzle and then the long central taper connecting the two steeper tapers.

Close Limits on Breech Casing

To machine the stepped-diameter holes in the breech casing to specifications for concentricity and size presents a number of problems. Four critical diameters have the following limits: for the two ground diameters at the front of the breech casing and the ground diameter at the rear of the breech casing—concentricity within 0.0025 in. indicator reading; 0.0012 in. for size. The honed breech-block hole must not have a runout exceeding 0.0025 in. and the limit on size is 0.0029 in. The centrally located breech-block hole, which is approximately 19 in. long is blind, a circumstance which has caused development of an unusual processing layout and special tools to obtain the desired accuracy together with economical manufacture.

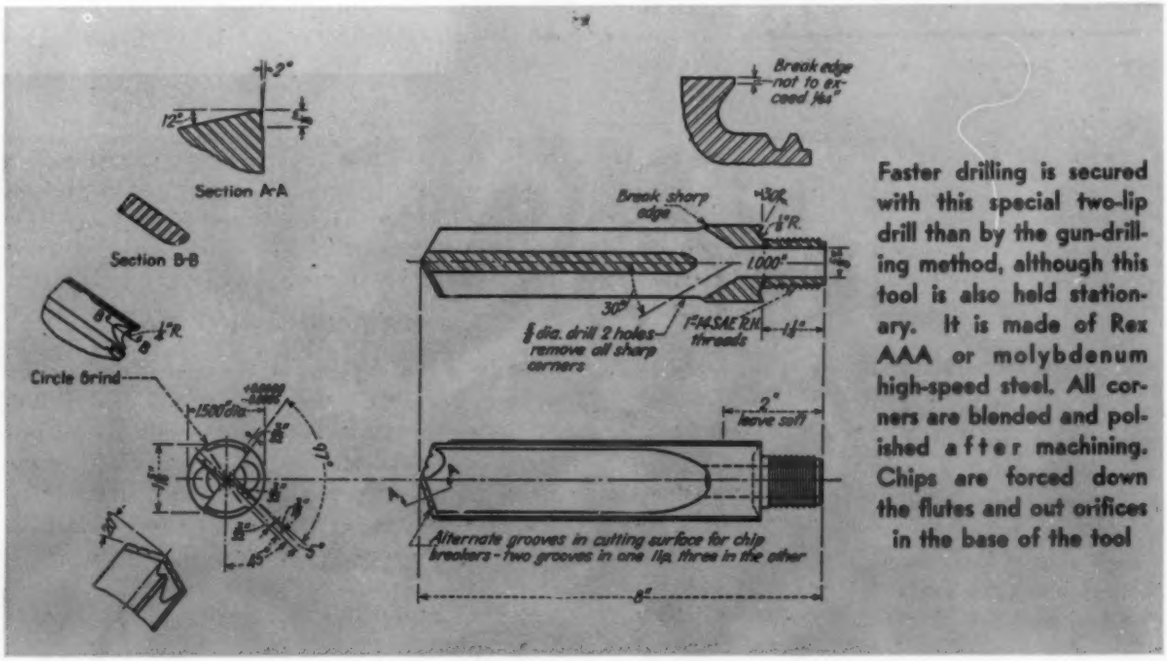
The breech block requires some 250 operations in all, and 44 of them are done prior to drilling the 1.492-1.500-in. hole through the axis of the part. These initial operations are mostly concerned with heavy slab and form milling of external surfaces, leaving 0.060-0.080 in. of material for finish milling after the stepped-diameter holes are completed. The casing is centered and the stub ends turned for pilots prior to drilling the through hole.

Drilling is carried out on a W. F. & John Barnes two-spindle horizontal machine; the operation is similar to gun drilling, except that a special two-lip drill is employed instead of a gun drill. The tool is supported by a long hardened bushing as it enters the work. Runout in the hole length of approximately 35 in. occasionally may reach 0.050 in., but usually is 0.015 to 0.020 in.

The two-lip drill, developed by the machine vendor, has been modified to some extent by: (1) notching chip breakers in the cutting edges, (2) adding more clearance at the drill point behind the cutting edges to promote rearward flow of chips, and (3) using a greater radius at the junction of the threaded stem and the tool body to overcome breakage at that portion. Cutting oil flows along a channel between two lands on the edges of each flute, washes chips down the roots of the flutes and out orifices at the rear end of the tool. Flutes must be polished to prevent the chips from jamming. Drilling is carried out at a feed of approximately $\frac{3}{4}$ in. per min. After being drilled, the breech casing is heat-treated to 286–321 Brinell.

The part is recentered, shoulders are faced adjacent to the pilots, the pilots are undercut and ground to a 0.0005-in. limit in a series of operations which condition the part for the more accurate work in connection with producing the stepped diameters.

The drilled hole is opened out to 2.00 in. in diame-

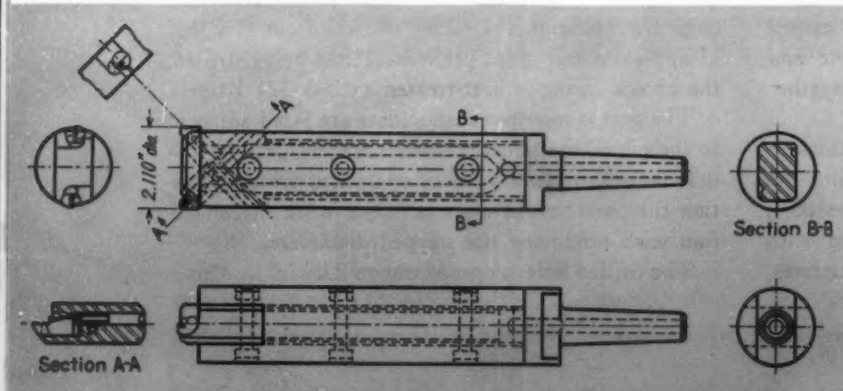

Section A-A
Section B-B
Circle Grind
Break edge not to exceed 1/64"
Break sharp edge
1/8" R.
1.000"
30°
1"-14 SAE RH threads
1/8 dia. drill 2 holes remove all sharp corners
2" leave soft
Alternate grooves in cutting surface for chip breakers - two grooves in one lip, three in the other
8"

Faster drilling is secured with this special two-lip drill than by the gun-drilling method, although this tool is also held stationary. It is made of Rex AAA or molybdenum high-speed steel. All corners are blended and polished after machining. Chips are forced down the flutes and out orifices in the base of the tool

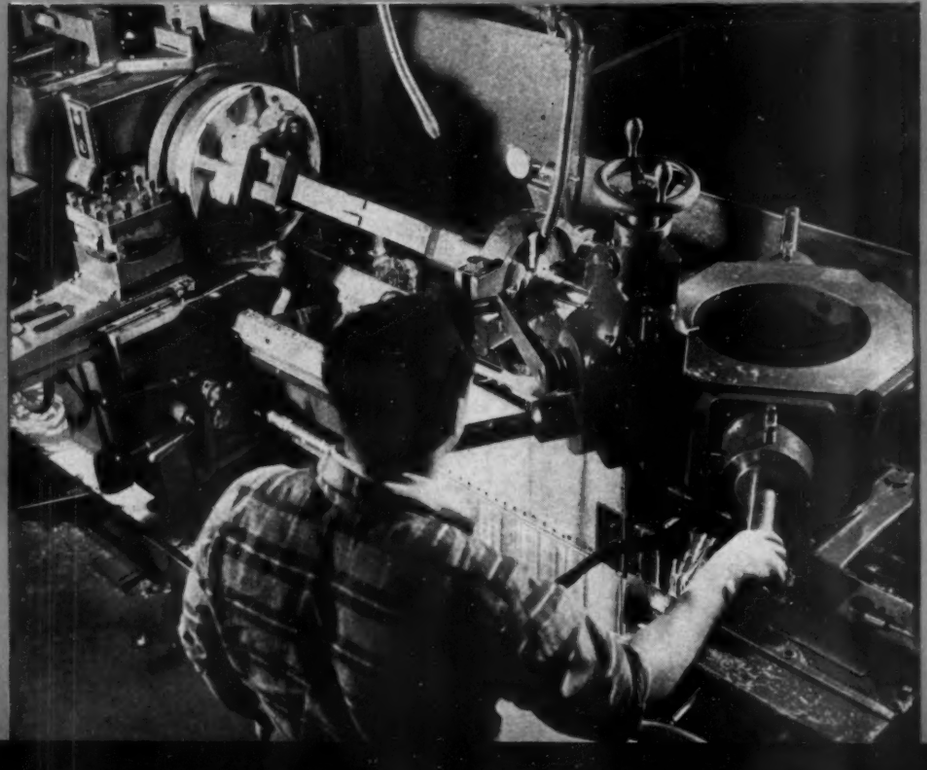
ter for a depth of approximately 25 in. by core drilling. A five-flute core drill gives satisfactory results when ground properly. Chips are forced out the drilled hole ahead of the core drill. The core drill is driven by an oil tube; the oil passes through the drilled hole in the tool to orifice holes at an angle to the axis about an inch back of the point. It has been found that the orifices in the tool tend to clog, and new core drills will be solid, the orifices being located in the oil tube. Oil will flow from these orifices to surround the entire core drill and force chips into the previously drilled hole. Original core drills were 5 in. long. Current drills are 11 in. long and are guided at the start of the cut by a full-length hardened bushing. As a consequence, runout of the drilled hole (which may reach 0.050 in.) is reduced to 0.010 in. at this stage.

To promote accurate and rapid location of the breech casing in all operations connected with machining the stepped-diameter holes, Pontiac is applying hinged steadyrests to both headstock and tailstock. By loosening two clamping nuts, the operator can open up the two steadyrests simultaneously and remove the part easily by an overhead hoist. A female center was used at the headstock in conjunction with a four-jaw chuck, but it has been found that operators may overlook checking runout of the piece with dial indicators before proceeding with the operation. Hence, a hinged-type steadyrest with hardened steel semicircular inserts is now being incorporated in a pot chuck on the headstock. The steadyrest at the tailstock end is fitted with Ampco bronze inserts to take wear. These Ampco inserts are trued up at intervals.

In the original processing layout, the stepped diameters at either end of the piece were opened out after the breech-block hole had been reamed, pack bored and honed. This meant that tools had to feed approximately 25 in. But since the rear hole must be machined to a larger diameter, it was decided to open it out first, and save the time of feeding the reamers and pack bore through 6 in. of metal which would be removed later anyway. Warner & Swasey No. 3A



Babbitt guides on the pack-boring tool have a length of three and one-half times the bore diameter to prevent runout of the tool. A long steel bushing guides the tool as it cuts its own start in the previously reamed hole



Three diameters at the front end of the breech casing are bored, recessed and counterbored on a Warner & Swasey turret lathe. Doing this operation before boring the through hole, reduces the distance through which the pack-boring tool must cut

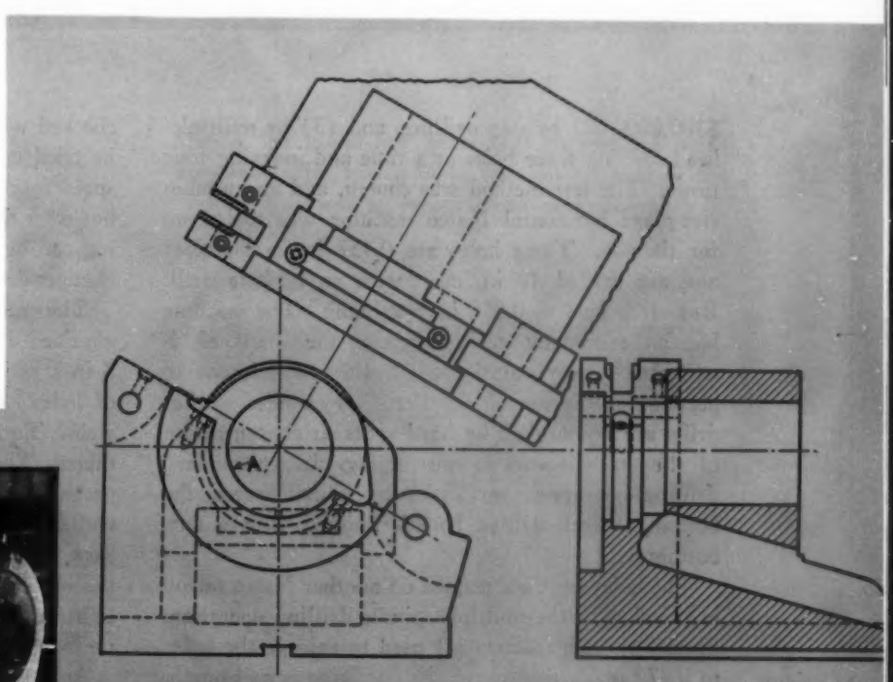
turret lathes are employed to rough and finish bore the rear end of the breech case and rough and semi-finish three diameters at the front end.

The 2.00-in. core-drilled breech-block hole has now been reduced to approximately 19 in. in length. The current set-up provides for rough-line boring to 2.110 in. Pack boring is then done to 2.161–2.163 in., using long babbitt bearing surfaces on the tool insted of wood packs. The pack bore is guided by a hardened steel bushing entering the hole at the rear of the breech casing. After the breech-block hole is honed, the two principal diameters at the front end and the hole at the rear are ground.

This set-up will be changed as follows: After core drilling to 2.000 in., the 19-in. long breech-block hole will be line bored wit ha double-blade tool. The two bits will open the core-drilled hole to 2.100 in. and 2.140 in. respectively. Critical hole diameters will then be ground, so that hardened steel bushings can be entered at both ends of the piece to guide the final line-boring bar, which will finish the breech-block hole to 2.161–2.163 in. In other words, the pack-boring operation will be eliminated. Pack boring has given a good job—a maximum of a 0.0025-in. run-out—but line boring in a lathe will be faster, because the boring bar will rotate, not the work. Besides the runout will probably be much less. Honing the breech-block hole to 2.1654–2.1683 in. will thus become the last operation in the sequence related to producing this group of holes.

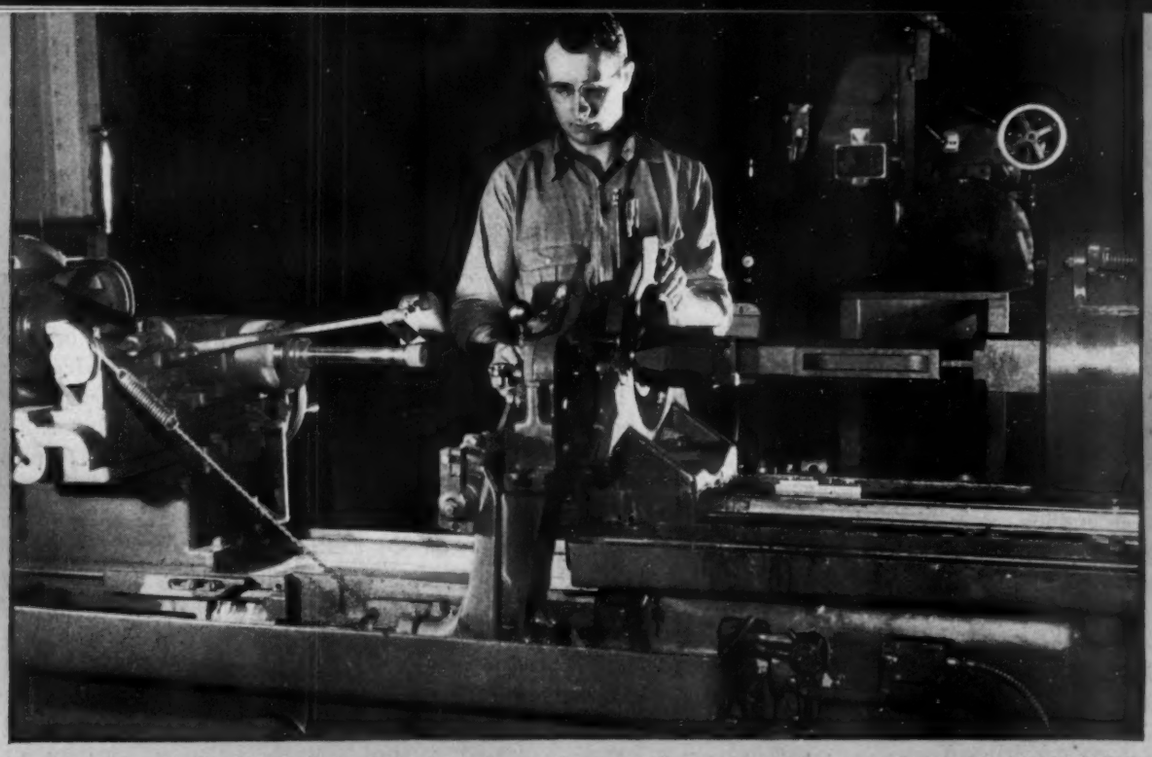
Specifications for the assembly of the buffer plate to the breech casing pose several manufacturing problems. The buffer plate has four prongs that fit closely in four radial slots milled parallel to the axis of the breech case. The prongs bear against twelve buffer springs in holes which continue beyond the radial slots, but these prongs must fit snugly and yet slide properly in the slots. The radial slots are produced by milling out the webs between buffer spring holes to a depth of approximately 3 in.

The twelve holes could be drilled in three ways. (1) by deep-hole drilling equipment costing over



To prevent set-up errors through failure to indicate the breech casing, and to speed up placement and removal of the work piece in the machine, Pontiac has developed this type of steadyrest. Hardened-steel locating rings *A* are used on pot chucks; Ampco bronze rings for dead centers

Pack-boring the breech-block hole reduces the runout from 0.010 to 0.0025 in. maximum. The steel bushing, shown partially pulled out of its bearing, enters the large hole at the rear end of the breech casing, to guide the babbitted pack-boring tool



Two diameters at the front of the breech casing and one at the rear must be ground on a Heald No. 72-A5 internal grinder to concentricity limits of 0.0025 in. and size limits of 0.0012 in. Stock removal at the front end of the part is 0.010 in.; at the rear, 0.0125 in.

$100,000, (2) by step drilling, and (3) by multiple-head drilling three holes at a time and indexing four times. The last method was chosen, and an automotive-plant horizontal Natco machine was tooled up for the job. These holes are 0.457 in. in diameter and are drilled 10 in. deep with an oil-hole drill. Runout is held to 0.015 in. maximum. The machine has an automatic cycle whereby the drillhead is advanced ½ in. into the work, then withdrawn to permit flushing out chips. Feed is hydraulic so that drills are not broken by hard spots or concentration of alloy constituents in the forging. In a secondary drilling operation, performed on a drill press, the bottom of each drilled hole is finished with a flat-bottom drill.

The holes are then reamed on another Natco set-up identical with the multiple-spindle drilling operation. Special oil-hole reamers are used to enlarge the holes to 0.472 in. diameter, but the operation is principally employed to straighten the holes, not to size them. Runout is reduced to 0.001 in. per in.

Carbide Drills to Be Tried

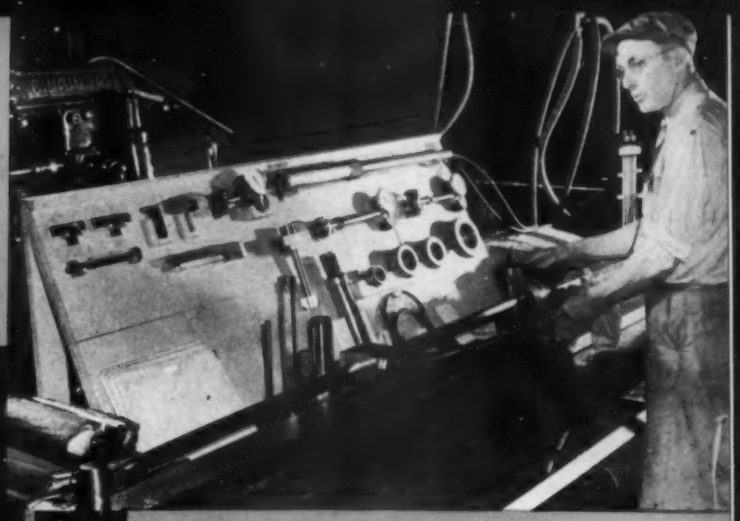
Not daunted by departure from tradition, Pontiac has experimented with the use of gun drills for this component. The drills are rotated by the drillhead, not held stationary as is customary. The runout has been cut in half as compared to the drilled and reamed hole. All holes were the same size and could be checked with the same arbor. Carboloy tips will also be tried upon *rotating* gun drills driven by a higher speed machine now on order. Feed will be reduced, but with the Carboloy tools it is expected that reaming can be eliminated, production increased and tool changes decreased.

The radial buffer slots in the breech case are obtained by removing the webs (for a distance of 3 in.) between the holes in each of the four groups of holes. A butt drill is employed to cut away the webs. To finish the radial slots two milling cuts are taken. The inner wall of the slot is thin. Cutting pressure of the end mill tends to collapse the inner wall, so that after the cut is taken the wall springs back, causing an interference fit with the prongs on the buffer plate. To prevent this situation, a hand-tightened expansion plug is inserted in the bore of the breech casing prior to milling the buffer slots.

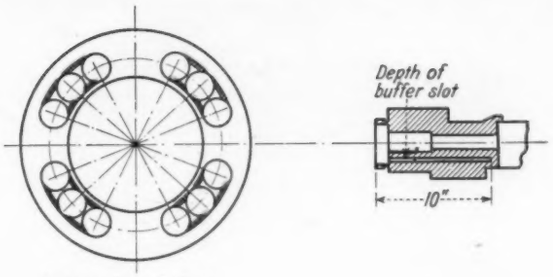
Approximately 0.018 in. per side of slot is removed by milling. The rough cut removes 0.010 in. and is performed with a right-hand spiral, right-hand-cut end mill. Finishing removes 0.008 in. and is done with a left-hand spiral, right-hand-cut and mill. In other words, the finishing end mill cuts across the pattern produced by the roughing cutter.

Two threads on the breech casing are ground from the solid, because of the limits involved. These operations are performed on an Ex-Cell-O thread grinder fitted with an internal attachment. When

Inspection of the breech casing after machining the stepped-diameter holes involves fifteen checks



Multiple-spindle drillheads are employed on Natco equipment for producing twelve buffer spring holes in the end of the breech case. The operator is shown checking the holes after reaming



Enlarged End View

Milling the metal left after butt drilling the webs between buffer spring holes requires support of the thin inner wall by means of an expansion plug

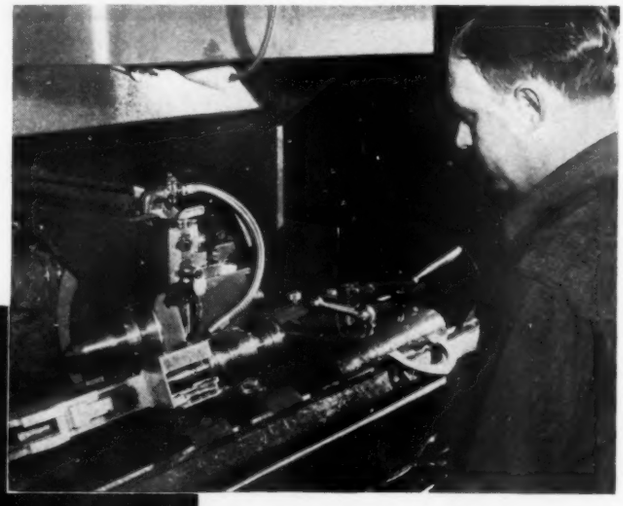
Rough and finish milling the radial buffer slots is carried out on a Milwaukee Model K miller fitted with a universal head

the machine is set up for external grinding, an Acme position-type thread is ground behind the triggerbox portion of the breech casing. This thread must be positioned within ±30 min. of a reference point, so that a locking cap will screw up tightly and lock against a machined surface. Grinding is done with a wheel speed of 1,000 r.p.m. and a work speed of 3 r.p.m. An interrupted 60-deg. thread is ground in one of the holes in the breech casing, the operation being performed on batches of parts after setting up the internal grinding attachment on the machine.

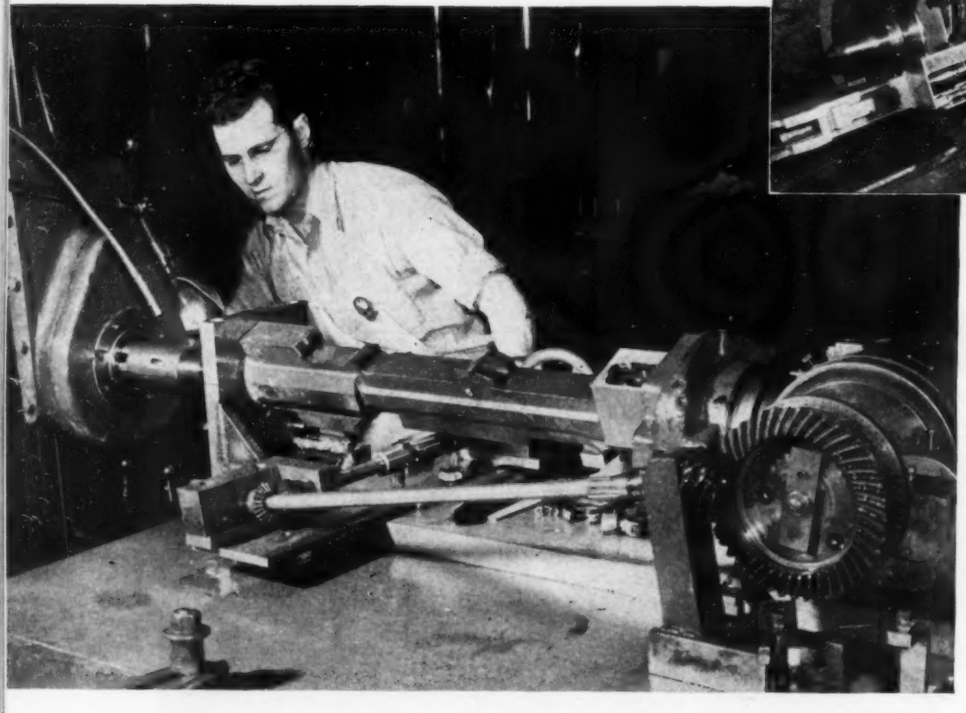
Internal Grooves Slotted

Internal locking grooves in the breech casing must be machined to the same limits for spacing and accumulated error as the locking grooves on the barrel—0.0008 in. total limit. Prior to cutting the grooves, interruptions in the thread-like locking elements are produced by cutting radial slots parallel to the part axis. A milling set-up was tried for this operation but proved too flexible because of the overhang. The grooves are located approximately 3½ in. within the body of the breech casing. A slotting attachment was set up on a Milwaukee miller and fitted with a heavy toolholder, of such diameter that there is just clearance for bar and tool within the hole. This holder is fitted with a single toolbit, or flat form tool, which is ground on a Pratt & Whitney profile grinder. Profile of the toolbit's cutting edge consists of a round nose at the center and a radius at either side. Thus the tool finishes the junctions between the radial slot and the interrupted surface in which the locking grooves will be cut.

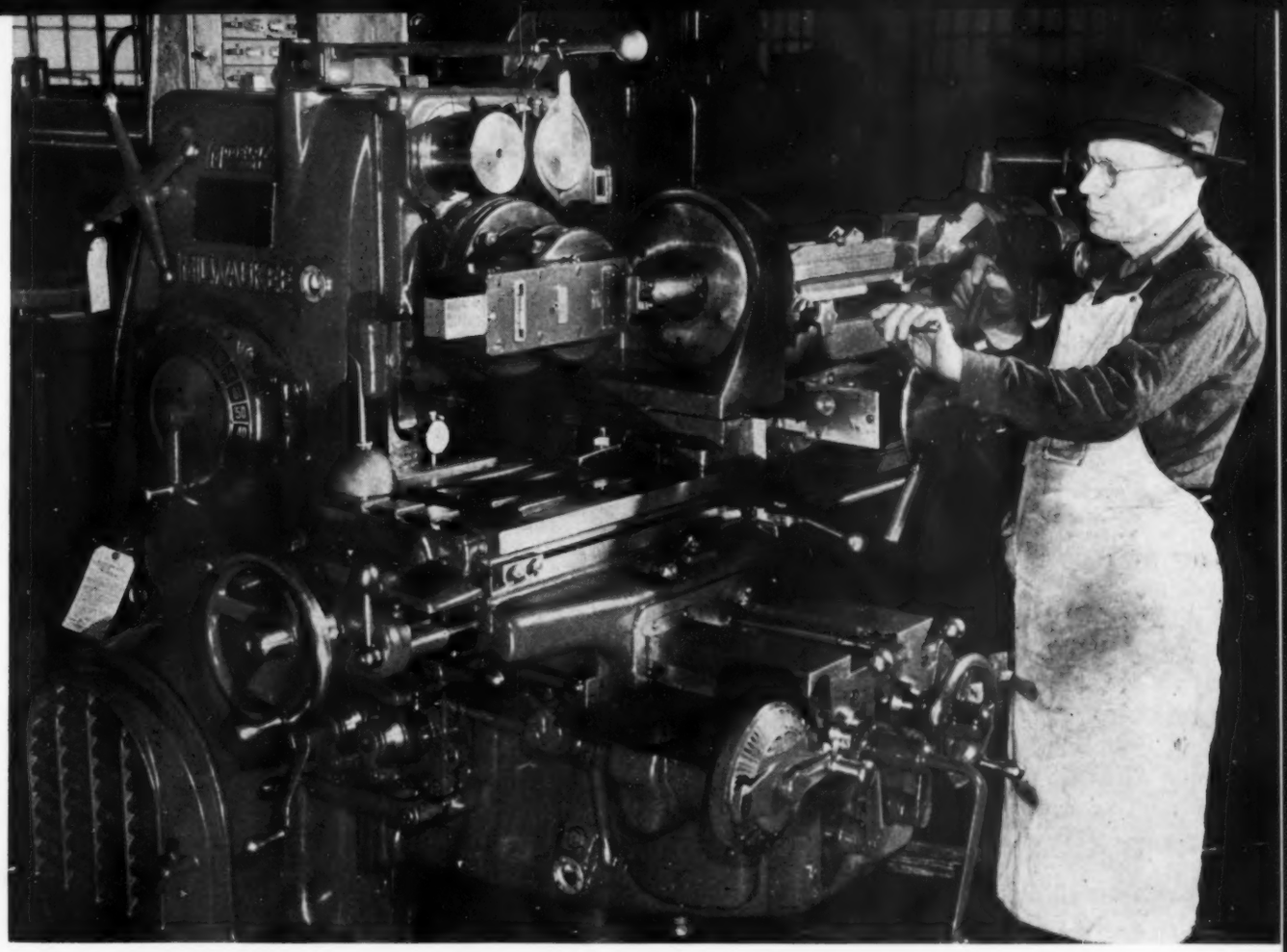
The machining of the internal locking grooves of the breech casing is just as difficult as the external locking grooves on the barrel, but is carried out on a Warner & Swasey turret lathe instead of an engine lathe. Each of several turret tool bars employed for roughing, semi-finishing and finishing the grooves is fitted with a special toolholder. This toolholder fits into a recess in the tool bar and is accurately located with dowels. Set-up of the toolbits in the toolholders



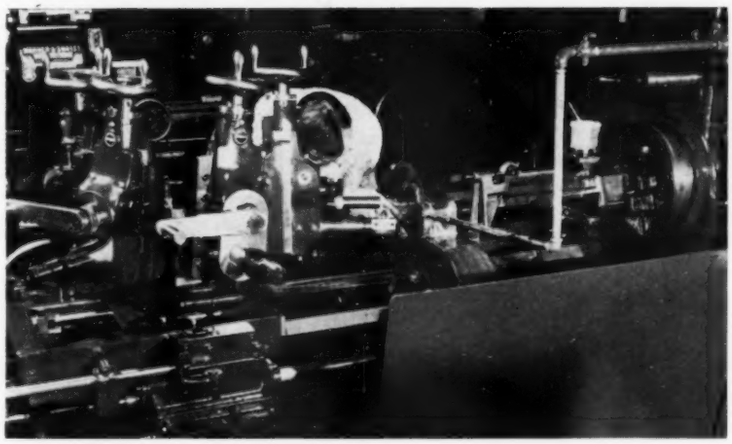
An Ex-Cello-O thread grinder is employed to grind the position-type external Acme thread on the breech casing, and an interrupted 60-deg. internal thread in one of the holes



To get operations underway, milling the radial buffer slots was started on a Universal horizontal boring machine. The homemade fixture for rotating the part includes an ingenious application of automobile differential gears connected to a standard dividing head



Interruptions in the internal locking grooves, by which the barrel is held in the breech casing, are slotted with an attachment fitted to a Milwaukee milling machine



Internal locking grooves are machined in the breech casing by single-point tools. Three toolbits are held in a special toolholder fitted to each turret tool bar

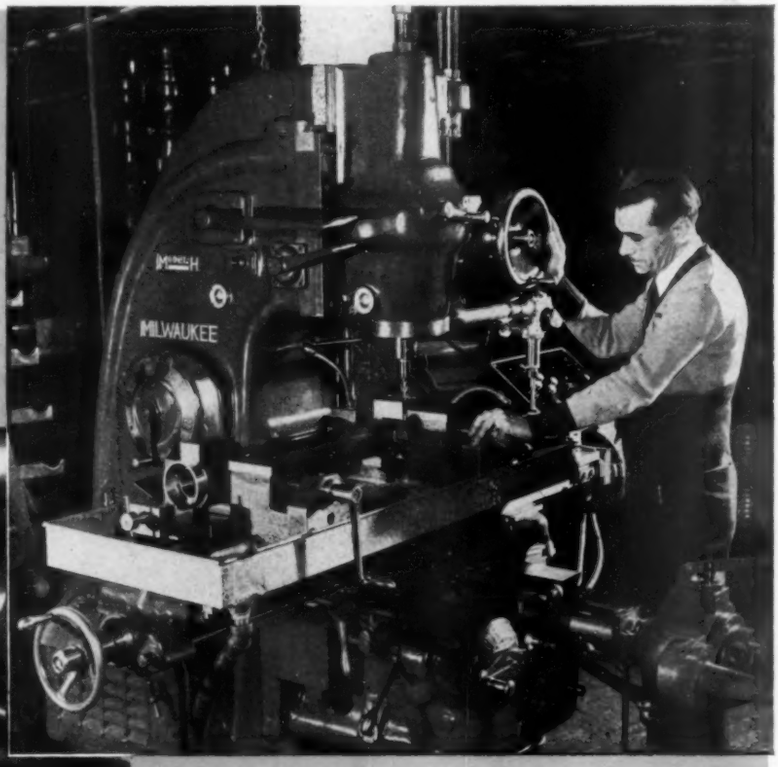
is checked in the toolroom prior to installation on the lathe. Single-point tools are found best for this operation. To avoid the set-up and grinding time required for individual toolbits, Pontiac attempted to use a single circular form tool designed to cut all three slots at once. The close limits for size and proper relationship on the part defeated this objective, because any movement of the turret would cause the circular form tool to cut over-size for groove spacing.

Approximately 20 operations were required in the original processing layout for the trigger box opening in the breech casing. This opening includes several rectangular openings, deep slots, pockets and pads. The complexity of the operations involved has compelled the adoption of new methods for some operations and the consideration of revisions on parts prints to accomplish faster manufacture.

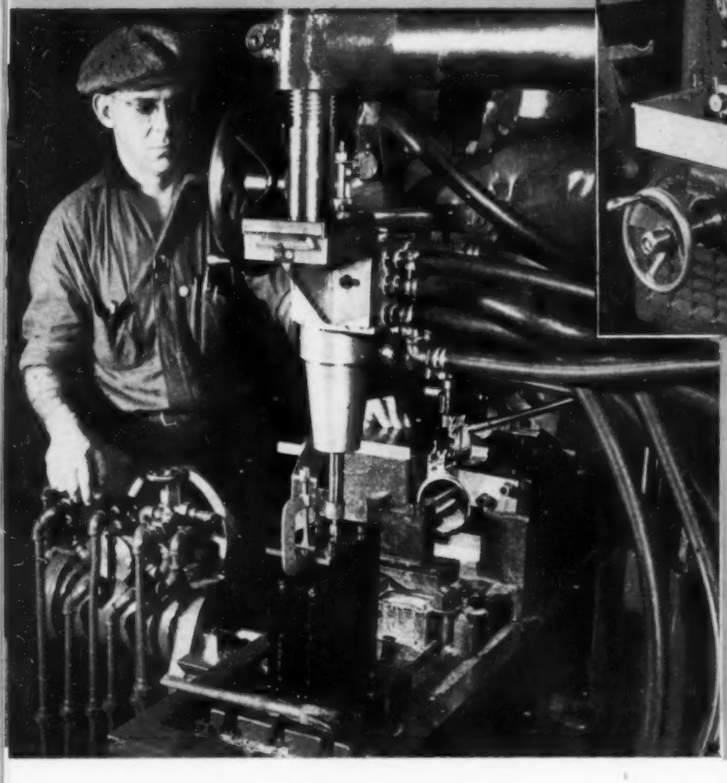
The opening is started by drilling three $1\frac{1}{2}$-in. holes through the wall and into the bore. Webs between the drilled holes are removed with a butt drill. Principal task is to make the rectangular opening square, and with the sides blending with corner radii. These radii are small, and are conducive to trouble in finishing the sides and ends of the opening to required limits and blending them with the radii. Finishing the sides of the opening must be done with $\frac{5}{16}$-in. diameter

end mills having a flute length of 2¼ in. A sharp cutter and a light feed are required. Roughing cutters have a right-hand spiral, finishing cutters a left-hand spiral to cut across the pattern of scratches produced by the first cutter and remove a few thousandths of metal. Obviously larger-diameter, less flexible cutters would speed up the operation, but a change in corner radius would be required.

The trigger-box opening has a large number of operations involving milling a form or radius to total limits of 0.004 in. The work is tedious, and most of the employees are former auto plant workers and others not accustomed to milling to toolroom accuracy. Accurate locating fixtures have been supplied on the machines, but it was found that operators might inadvertently ruin a piece which had received over 100 operations. Dial indicators were applied to table movements, but without totally overcoming scrap losses. Hence Pontiac has already equipped a large number of its knee-type millers with duplicating attachments. Upon machines so equipped, the tracer contacts an accurately-made former plate, and is confined within the form so that the cutter cannot be run too deep into the piece. A further advantage of the duplicating attachments is that several related operations can be performed in more rapid sequence, because the operator need change only the former plate, tracer and cutter, instead of making a new set-up.



An opening in the trigger box is rough and finish milled on a Milwaukee Model H miller fitted with a Detroit Universal Duplicator attachment. The tracer actuates electrical contacts, which control the hydraulic system powering the table feed



In another duplicating set-up, a Turchan all-hydraulic attachment controls table movement of the Cincinnati machine which mills a pocket at the bottom of a deep slot in the trigger box. Approximately 150 operations have already been performed on the breech casing, and a slip in hand feeding would ruin a valuable piece

Training Within Industry

BY C. D. MOORE, WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY

To increase efficiency, speedy production during the defense program Westinghouse has more than doubled enrollment in its labor training trades courses

WESTINGHOUSE PLANTS all over the nation are moving into high gear to aid the national defense production program. A corps of Westinghouse men in various localities has been entrusted with the all-important task of training thousands of men for vital defense jobs. The company's participation in the emergency training program of the United States reaches into three classifications: training within industry; vocational school training for machine tool operators and welders; and engineering defense training. This article considers only Westinghouse's part in training within industry.

Playing its part in this program, the company has expanded its trades training program to include more than double the normal enrollment of students in two and four-year training courses. Most of this work is being conducted at the East Pittsburgh Plant, although the plants at South Philadelphia, East Springfield, Baltimore and Sharon, Pa. have added scores of students.

Unique in the emergency training activities is the system inaugurated several months ago by the Transformer Division, at Sharon, which set up a streamlined drafting apprentice course.

The supply of trainees is very inadequate. This is due in part to the general curtailment of training activities of most companies during the economic depression beginning in 1929. Then, too, the more recent changes in manufacturing methods and the increased load placed on many defense plants since the emergency began has placed the emphasis on a need for men, not necessarily skilled mechanics, but who are capable of doing many of the operations of semi-skilled occupations, such as machine operation, apparatus wiring, assembly, sheet metal work, and other jobs.

In addition, to provide for the increased production made necessary by the national defense program industry is now faced with the necessity of increasing rapidly the number of men on the roll who are skilled workers in certain occupations.

Applicants for apprenticeship in the mechanical trades training courses are tested for their mechanical aptitude. One of these tests requires that the applicant assemble wooden pieces to form a cube-shaped block. The length of time taken and the manner in which the applicant assembles the block is a test of his mechanical aptitude

Westinghouse has for many years conducted regular apprenticeship training programs in its many plants throughout the country. To meet the need for the large increase in skilled workers the company has increased, to a large extent, the number of men on the regular training programs and has introduced additional courses. To aid in providing for the increased number of tool makers, die makers, machinist journeymen, foundrymen, pattern makers, etc., the number of apprentices on the regular four-year trades training courses has been increased. To increase the available supply of capable workers on many of our semi-

skilled occupations, two-year courses of training have been organized. To meet the additional requirements, due to the national defense program, the system of up-grading and training of new workers has been extended.

Entrance requirements for our four-year trades training courses make it necessary for applicants to be high school graduates between the ages of 18 and 21. Applicants who have taken a vocational course are preferred. Those who have taken a commercial course are not accepted.

The following is a general description of these training courses given at the East Pittsburgh Works.

Apprentices and students on both the two and four-year courses are given the same classroom work during the first assignment. This includes a general review of arithmetic, dealing particularly with the practical application of work being performed in the shop. Students are also instructed in blue print reading, shop terms, and the nomenclature of machine tools.

Lectures are given on company organization and history, and on the relation between the sales engineering, financial, and shop divisions. The proper functions of each are explained and the necessity of having cooperation between divisions is indicated. The rules and policies of the company are explained with particular attention being paid to safety rules and state safety laws. Every effort is made to impress the apprentice with the importance of working safely both for himself and his fellow workmen.

After satisfactorily completing this assignment, the apprentice or student then advances to the first assignment dealing specifically with problems of the trade or occupation he is learning. The text material is arranged in a steady progression of subjects so that each apprentice or student may be allowed to advance as rapidly as possible. Those completing regular assignments before the end of the course are given advanced work covering manufacturing and management problems, tool designing and industrial psychology.

Apprentices and students are graded on their classroom work three times each year: the first week in January, in May and in September. The apprentice receives a transcript of his grades for his own records and for the information of parents or others interested.

Reading assignments covering the construction and operation of machine tools, the heat-treating of steel and other shop work are given to the apprentices and students who are required to turn in written reports on these assignments. The grades made on the reports are factors in compiling semester grades made up for each student.

Educational motion pictures which tell the story of steel and copper from the mine to the finished product, the story of machine and assembly operations in our own plant and in the plants of other manufacturing concerns are shown at intervals throughout the course.

While the need for skilled workers such as toolmakers, diemakers, machinist journeymen, patternmakers and many other occupations may be filled by a four-year trades training course, there are many occupations or jobs that require men who have had a certain amount of experience and training, but not necessarily a four-year course. For example, it is very difficult under ordinary conditions to hire through the regular employment channels men who are capable of doing a satisfactory job on many of our machining operations, wiring, sheet metal work and other occupations. To take care of this need, however, we have organized a two-year training course.

Apprentices in the Trade Training Course at Westinghouse's East Pittsburgh Works are aided by instructors who correct their mistakes and instruct them in proper operating procedure. The apprentice is keeping a watchful eye on a piece of work he is turning in a lathe. His instructor checks his operations

Entrance requirements for this course are that the applicant be a high school graduate between 18 and 22. The preferred age is around 20. The same method of selection is followed for this group as for the four-year apprentices and much the same procedure of instruction is followed in the classroom. Of course, these students receive instruction for only two years and, therefore, are not given the advanced subjects taught to the four-year apprentices.

The student on machine operation is taught blueprint reading, shop analysis and mathematics relating to machining operations. Wiring students are taught blueprint reading, wiring diagram reading, shop analysis, theories of a.c. and d.c. electricity and mathematics relating to the electrical work. Students instructed in sheet metal work are taught shop analysis, blueprint reading and mathematics relating to the sheet metal work. The latter students also have a number of projects which they are required to lay out and develop first on paper and later on sheet metal. Each student spends four hours a week in the classroom and thirty-six hours in the shop.

During the two years in the shop students work on jobs in groups with regular workmen. The machine operators are given instruction on at least three different types of machines. The sheet metal students are given a complete assignment in the shop covering all the layout work, forming, bending, grinding and welding incidental to sheet metal work. The apparatus wiring students are given experience on all kinds of switchboards and panels and the shop wiring students are given instruction in all kinds of maintenance and installation wiring.

Students and apprentices for our training course are selected by means of competitive tests arranged and conducted by instructors who are trained and skilled in testing and grading.

The following steps are taken in selecting apprentices:

1. Interview
2. Interest test
3. General knowledge test
4. Reason and mathematical ability test
5. Simple mechanical aptitude test
6. Advanced mechanical aptitude test
7. Final interview

No matter how elaborate the training program or how adept the apprentices and students to be trained, little good and possibly great damage may be done if the right instructors are not selected. A good instructor must have had wide experience in training. He must be helpful, understanding, tolerant and naturally sympathetic. He must be of good appearance and have confidence, be a convincing speaker, firm in purpose and be willing to continue his own study. He should be able to understand the humblest workman and the executive. Most important of all he must have learned these things from actual experience.

AMERICAN MACHINIST REFERENCE BOOK SHEET

Carbide-Tipped Face Mills—I

BY F. W. LUCHT, ENGINEER, THE CARBOLOY COMPANY

WHEN FACE MILLING on a universal knee-type milling machine, the table must be set at zero position, making the table travel normal to the centerline of the cutter spindle, or slightly past zero by an amount not greater than 0.002 in. in 18 in., so that the trailing portion of the cutter will not spoil the work. When face milling on a plain milling machine of either the horizontal knee or the vertical type, the angular relation of the milling machine spindle to the direction of table travel is such that the trailing portion of a cutter which is properly ground will not spoil the finish on the work. This also applies to the manufacturing and planer type of millers.

When the tapered hole in the machine spindle is used to centralize a face mill, it must be clean, so that a uniform metal-to-metal fit for the full shank length is obtained.

Observe the following precautions when using cemented carbide-tipped cutters:

1. Never disengage spindle while feed is engaged.

2. Always have the cutter rotating before feeding work up to cutter.

3. When using machines with rapid traverse, make certain that the rapid traverse is out, and the regular feed in, before the work contacts the rotating cutter.

4. When stopping the machine, first throw out the feed, and then immediately disengage the clutch spindle.

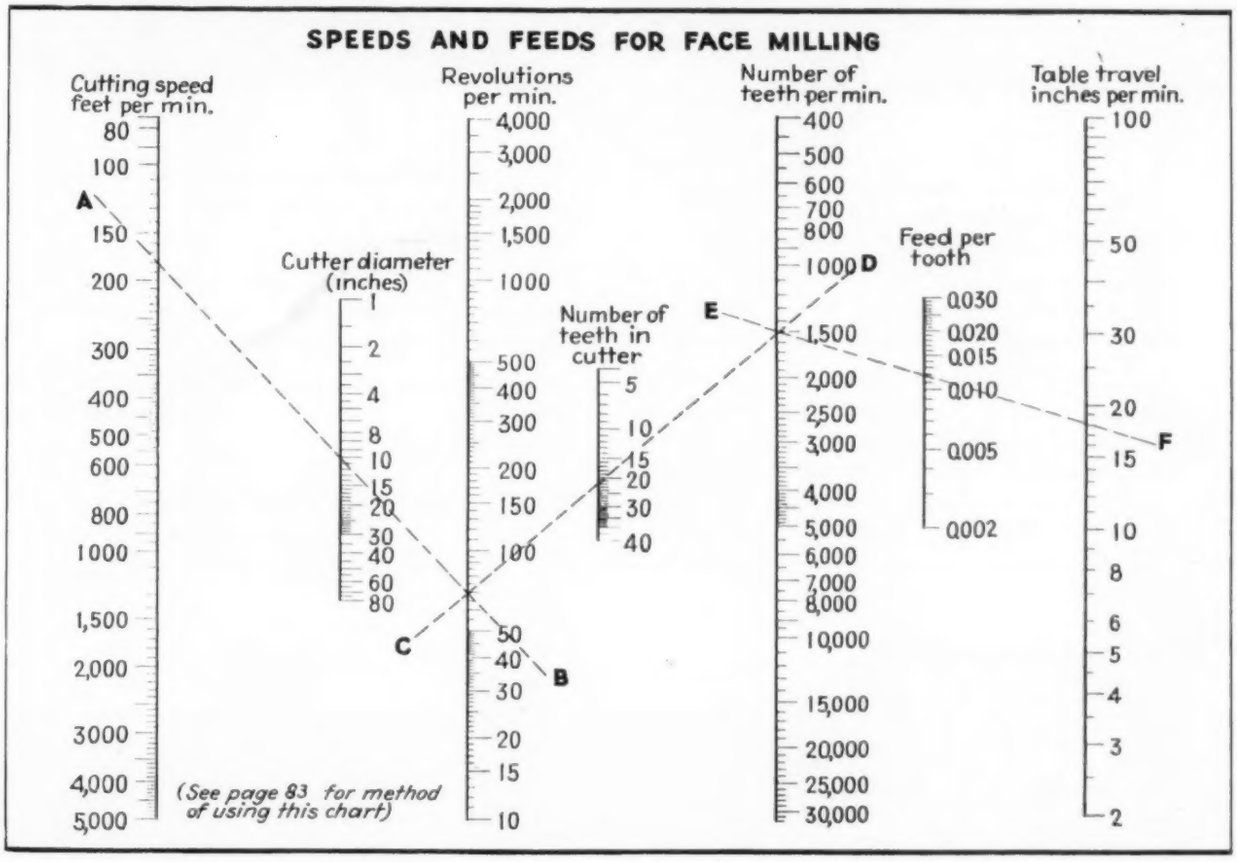
5. Never allow the cutter to idle in the cut as the rubbing of the cutting edges against the work has a lapping effect on the cutting edges which dulls the cutter.

6. Keep the cutter rotating when returning the table to starting position after a roughing cut.

7. After a finish cut, the work should be removed before returning the table.

In addition, keep the backlash in the feed screw at a minimum; lock the knee and saddle securely before starting a cut; adjust table gibs to give the table a snug sliding fit; check lubrication to make certain that it is adequate and properly applied; keep end play in the machine spindle at an absolute minimum; and wipe chips from the ways before moving the table saddle or knee.

The general nature of the work and the proper clamping of the work on the machine table has a direct bearing on the success or failure of any milling operation. Proper clamping is especially important when cemented carbide



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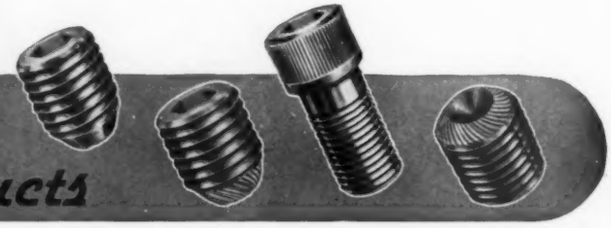


AMERICAN MACHINIST REFERENCE BOOK SHEET

Carbide-Tipped Face Mills—II

SPEEDS AND FEEDS

MATERIAL	Suggested range of cutter peripheral cutting speeds and recommended starting speeds in ft. per min.
Aluminum	500–3000 Max. Mach. Speed
Brass—Hard and Soft	800–1000 900
Bronze—Tough	100–1000 250
Bronze—Soft	800–1000 900
Cast Iron:	
Soft Gray	180–250 200
Medium Gray	160–225 180
Hard Gray	130–200 160
Steel Content Below 25%	150–225 180
Steel Content—25%–40%	160–300 200
Steel Content over 40%	180–350 220
Copper	300–1000 Max. Mach. Speed
Fibre	300–800 600
Malleable Iron—Hard	150–225 180
Malleable Iron—Medium	160–300 200
Plastics	500–1500 800
Steel—Carbon and Alloy Cast	Consult Carbide Supplier
Zinc Alloy Die Castings	300–1000 500

Suggested Range of Feeds expressed as feed per tooth and recommended starting feed per tooth in inches, as applied to face mills

Roughing	0.012 to 0.017 in.
Start	0.012 in.
One-pass Finish	0.008 to 0.012 in.
Start	0.008 in.
Finishing	0.005 to 0.010 in.
Start	0.005 in.

EXAMPLE

Material to be Milled	Cast Iron—Medium Gray
Type of Milling Cut	Roughing
Diameter of Face Mill	10 in.
Number of Teeth in Face Mill	22

METHOD

1. Select starting cutter speed in F.P.M. for cast iron-medium gray from table, as—180.
2. Place straight edge on nomograph in position AB, passing through 180 F.P.M. and 10 in. cutter diameter. Read 69 R.P.M. as approximate speed to set milling machine. (Select milling machine speed nearest to this speed.)
3. Place straight edge in position CD, lining up 69 R.P.M. with 22 (number of teeth in cutter), and read 1510+ as number of teeth per minute.
4. Select starting roughing feed per tooth from table as 0.012 in.
5. Place straight edge in position EF, lining up 1510+ teeth per minute with 0.012 in. feed per tooth and read milling machine table travel as 18.2 in. per min. (Select milling machine table feed rate nearest to above feed rate.)

cutters are used because increased rates of feed are usually employed. The ideal method of clamping any piece of work is to hold it rigidly, but still allow it to remain in a state of "rest" without torsional or bending strains. All cutting pressures should be against rigid stops and supports — never against the clamps. Clamp the part so as to keep the surface being milled as close as possible to the machine table, and keep the point of clamping opposite the point of support in order to minimize distortion. If a milling fixture is necessary, it should be heavy enough to (a) absorb all the forces created by clamping and cutting without springing or deflecting the milling machine table; (b) absorb the vibration developed by the cut. The construction of the milling fixture should allow for free flow of chips.

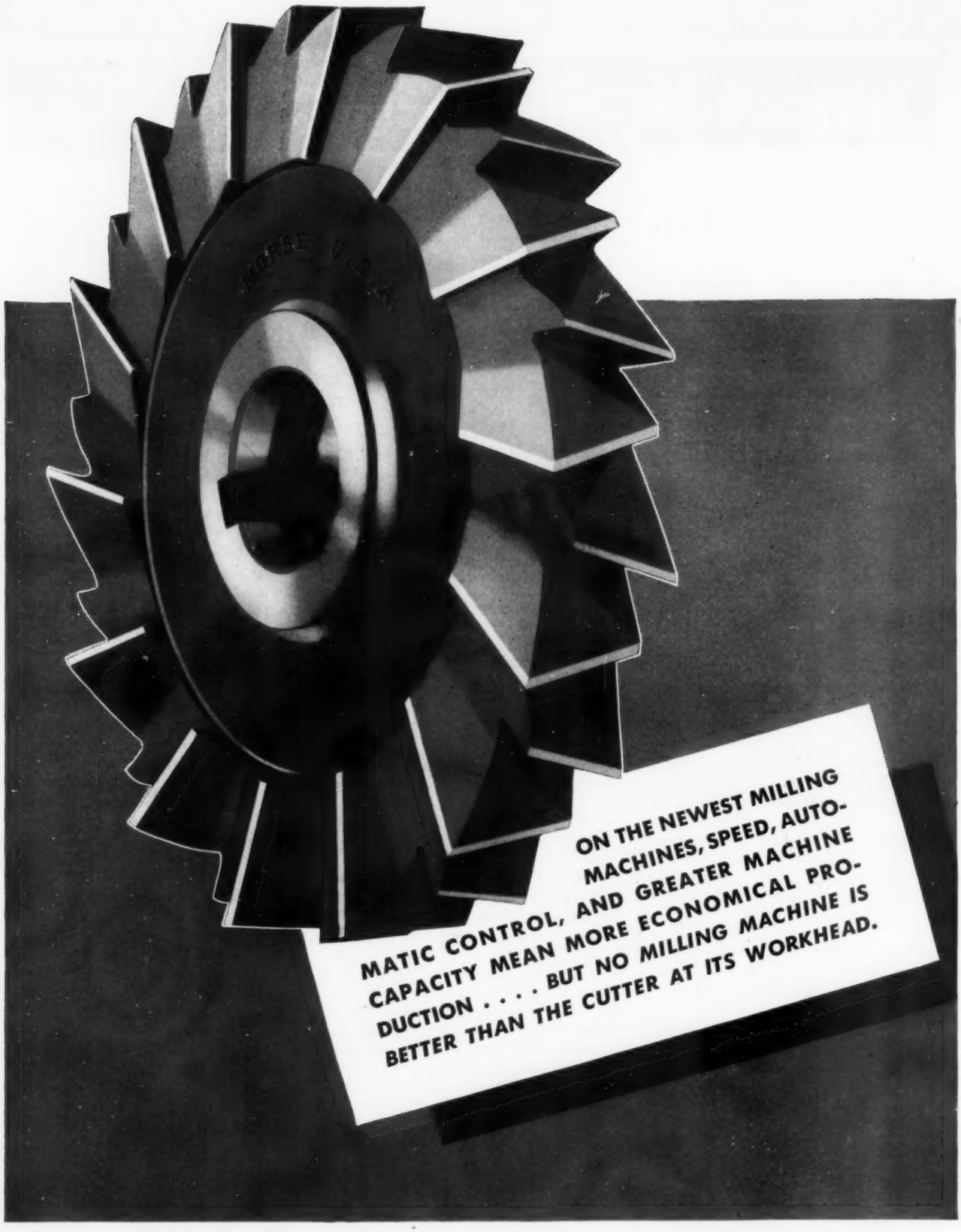
It is difficult to apply any fixed rule to obtain the correct cutting speed of milling cutters on various materials because of the many variables involved. Cutting speed is dependent upon: (1) the design of the milling cutter; (2) the rigidity of the machine and its condition, and the power available; (3) the rigidity of the fixture, or the method of clamping the part; (4) the material from which the part is made and its hardness, the rigidity of the part and the amount of stock removed; and (5) the length of intervals desired between each resharpening of the cutter. Production requirements may make long intervals or short ones between grinds desirable. When a job is set up for a given starting speed, it should also be run at speeds above and below that speed to determine which speed gives the most economical production. A cutter run at the maximum economical speed tends to eliminate the built-up edge and thereby gives a freer cutting action.

The proper rate of feed for milling a given piece of work with a cemented carbide tipped milling cutter is dependent on several factors. Some of these are: (1) the machine used; (2) the power available—if all other conditions are satisfactory, the feed rate is limited only by the capacity of the motor; (3) design of the milling cutter; (4) the fixture used or rigidity in clamping; (5) the shape, rigidity and hardness of the part being machined; (6) production rate—this should not be too low to give a light chip; (7) the degree of finish required, and (8) the depth of cut.

The logical method fo. determining the rate of feed in inches per minute for any milling cutter is to start from the feed-per-tooth basis. The feed per tooth multiplied by the number of tooth passages per minute (number of teeth in cutter times spindle feed in revolutions per minute) will furnish the approximate starting feed in inches per minute to be set on the machine. This can be obtained without computation from the accompanying table and nomograph.

When a job is set up for a given starting feed which is estimated will produce the desired degree of finish, it should also be run at feeds above and below the starting feed to determine which produces the most economical results.

Another installment of this series will appear in an early number.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ON THE NEWEST MILLING MACHINES, SPEED, AUTOMATIC CONTROL, AND GREATER MACHINE CAPACITY MEAN MORE ECONOMICAL PRODUCTION . . . . BUT NO MILLING MACHINE IS BETTER THAN THE CUTTER AT ITS WORKHEAD.

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Train Women and Older Men

CARELESS USE of our manpower in this war is one of the things that we must guard against. If the war is to be won in the shortest time, our manpower must be apportioned wisely between the military services and industry so that both can perform their jobs with maximum efficiency.

No one knows exactly how many men the Army and Navy will require. Some estimate seven to ten millions. Perhaps those figures are too high, but in any event our combined military and naval forces will be numbered in the millions.

Modern mechanized warfare needs young active men to carry it on successfully. Anyone who thinks that older men will do just as well because operating a tank is like running an automobile is 100 percent wrong.

This is a young man's war. Our prospective aviators are drawn from those in their early twenties. Most of the fighting, say military authorities, will be done by men between 20 and 27. Older men will be required too, but not in the same high proportion as the youngsters.

This whole matter of military service raises a delicate and serious problem for industry. The newer industries, such as aviation, have gravitated toward men in the 1-A selective service classification. All the war industries have large numbers of men in their thirties and forties, but also many in their twenties.

The government is determined to see that no industry, no matter how essential to the war, becomes the refuge of those who want to escape military service.

Manufacturers must be guided by the policy of the Selective Service Administration that no factory worker, merely because he is employed in a war industry, will be exempted from military service. Neither will a worker be granted permanent deferment. The burden of proof that a man is indispensable to industry rests on the shoulders of the manufacturer.

All of the war industries are urged immediately to train more women and older men. A majority of airplane workers in England, for example, are women. Thousands of women are now at work in our own airplane industry and more are joining the ranks every day. The government will not do anything to hurt war production, but neither will it tolerate a manufacturer's doing nothing to train new people to replace those of draft age.

One of the unsettling results of the feverish recruiting campaigns since Pearl Harbor has been that the skilled man at the bench has begun to wonder whether he is doing the right thing by staying there, even at a time when the greatest need of the hour is production of more and more and still more war equipment.

Manufacturers should not ask for deferment for men unless they are convinced beyond doubt that the men cannot be replaced. They must "shoot square" with their local boards and reserve their deferment requests for skilled workers who really count.

Wherever a man is essential, however, the manufacturer should pound home to the local board that this war will be won in America's workshops and that the skilled man turning out machine tools, planes, tanks and guns is just as valuable in the war effort as the soldier and sailor in uniform. The bravest and best trained soldiers are helpless without fighting equipment.

If a local board cannot see this obvious point and the manufacturer has a clear-cut, iron-bound case, he can take an appeal to the office of the Under Secretary of War. But in the main the decision rests with the local board. It is up to the manufacturer's persuasive abilities and resourcefulness to convince the board of his rightness.

Burnham Finney

GAGING BUSINESS

Retooling all existing usable machines, production of more and more machine tools are keys to conversion of metal-working industry to war production. Steel supply gets even tighter

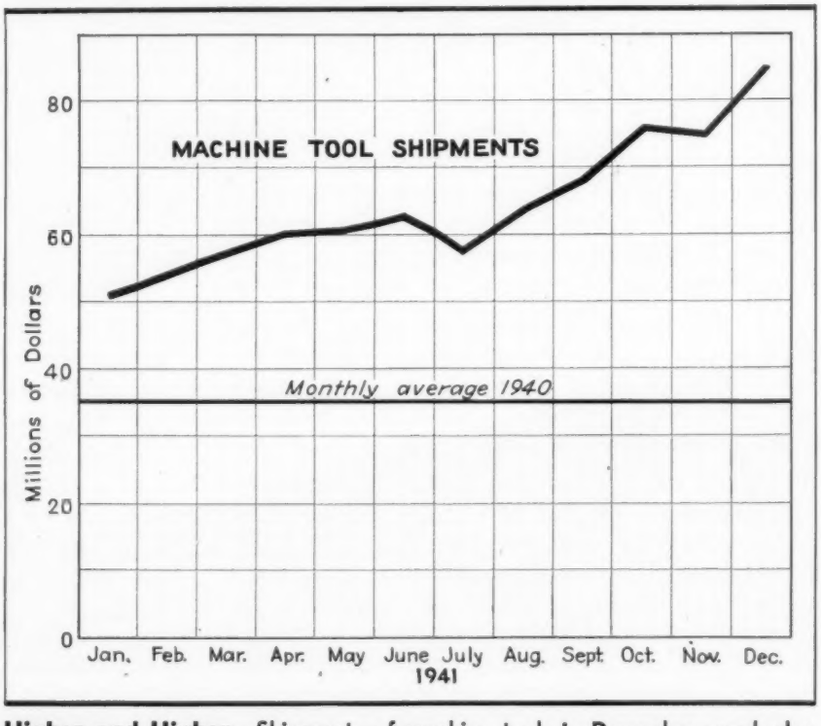
To speed the conversion of the entire metal-working industry from manufacture of peacetime goods to production of munitions, government authorities are pushing two plans simultaneously. One plan is to retool every existing machine that can be of use and to improvise operations on older machines rather than wait a long time to secure brand new tools. The other plan is to push expansion of machine-tool production as hard as possible to equip plants which are without the necessary tools to proceed with war operations. At best, however, the entire program for switching over to an all-out effort cannot proceed beyond a certain pace. It takes time to retool whole industries, and the public should not be disappointed if some time elapses before mass production of war goods is under way on a scale commensurate with the size of the victory program.

Machine Tools—With little fanfare machine-tool builders are shoving their volume of output to unheard of heights. Many companies are in the process of erecting new plant additions on top of those heretofore completed. Others are widening their subcontracting of work. A considerable number of companies have set as their goal a minimum workweek for production employees of 56 hours and a maximum of 60 hours. They also have adopted a policy of working men only six full days a week, though their plants be on a round-the-clock-schedule. Training of men is now at a peak. The industry today is employing over 110,000 workers, compared with less than 40,000 in a normal year. In seeking outside sources for construction of machine tools, Washington has looked to automobile manufacturers, but inquiry at Detroit reveals that few machine tools probably will be built in the automotive industry, which has its hands full with their problems of tooling up for war work. It won't be long until machine-tool builders will be producing almost $100,000,000 of machine tools a month, which will be the equivalent of their entire output in an average prewar year. The sales forces of most machine-tool companies, consisting of trained engineers, are spending a large part of their time in the field showing defense contractors how they can retool their plants with the least delay.

Munitions—Mass production of 20-mm. aircraft cannon has been attained, according to the Ordnance Department of the Army. Outputs have been tripled within the last month. The volume is expected to continue to climb rapidly. This cannon is automatic, firing armor-piercing and high-explosive ammunition with machine gun rapidity, yet having a greater caliber than any machine gun used by the Army. The Army's 105-mm. howitzer also has reached the mass production stage. It is designed as a divisional light artillery weapon and is highly mobile on its pneumatic tires. Government shell loading plants increased their production 200 percent in December compared with November. This gain is traceable to longer working days and to several new manufacturing lines which got into operation. Conversion of factories making peacetime goods to the manufacture of war products is progressing well. A Utica, N. Y., maker of table knives who now is producing bayonets is a typical example. A Syracuse, N. Y., firm is another example. It has turned from washing machines to anti-aircraft machine gun mounts, placing subcontracts with seven other washing machine companies.

Aircraft—The Navy has asked Congress for an additional $4,000,000,000 for aircraft. Indications are that the sum will go for protective craft—pursuits and fighters—to protect the fastly expanding fleet. The supplemental naval appropriation passed by the House provided $1,668,281,470 for the procurement of planes this year and next. The new fund will not be used until 1943 at the earliest. Backlogs of airplane orders already placed will keep existing plants going for months. Some orders may be placed in Canada, following the recent contract with Canadian Car and Foundry Co. for dive bombers.

Steel—The situation in steel is getting even tighter. Lease-lend demands for semi-finished steel are expected to be heavy during the spring months. The sharp increase in the war production program is already resulting in heavy specifications for structural steel for new munitions factories and for certain other war purposes. The active call for some types of steel for war projects has led to curtailment of production of other types as mills change over to manufacture of the desired types. That is particularly true of mills shifting to ship plate from sheet. Output of some open hearth furnaces have been cut down by the shortage of scrap. The American Rolling Mill Company has appealed to the government to help it find scrap to keep its furnaces going.



Higher and Higher—Shipments of machine tools in December reached a new record of $85,100,000 and pushed output for the year 1941 to $775,300,000. This figure, which is nearly 75 per cent above 1940's estimated shipments of $450,000,000 will be almost doubled in 1942. Employees of machine tool companies at year end exceeded 110,000

PRICE BILL TOO LATE TO HALT WAGE DEMANDS

Early Start Speeds Maritime Program; Order 713 Vessels

WASHINGTON—The Maritime Commission's advantage in merchant shipbuilding, over the War Department's airplane, tank, and gun production, becomes more obvious as time goes on. This advantage is due to the Commission's long start—from 1938.

The Administration was able to drive ahead toward a war objective in merchant ships, with the argument that the United States should recapture world sea commerce. There was no peaceful excuse for guns, tanks and war planes, and they had to wait.

Cut Building Time 25 Days

So the Commission sails along, far in front of the struggling munitions projects. In ten days recently, it awarded 713 new EC-2 ship contracts, totaling 7,500,000 tons—nearly equal to the 8,000,000 tons the President asked be built this year.

Construction is being hurried so that vessels now taking 130 days from keel to delivery, will take 105 days. The Commission will run into some delays in getting machinery, and may be held up for brief periods on some jobs, as it has been in the past, for lack of hull plate. No shortage of boilers is expected.

ASM OFFERS ADVISORY SERVICE

CLEVELAND—War Products Advisory Committees, offering free advisory service for the metal-producing and metal-working industries, have been set up by chapters of the American Society for Metals. The committees, which will be established by each of the 52 chapters, will give assistance on the problems of specifications, metallurgy, engineering, design and production.

Large staffs taken from membership lists are being set up to furnish immediate service. People wanting help should telephone the nearest chapter.

EASTERN PLANTS JOIN FOR WAR

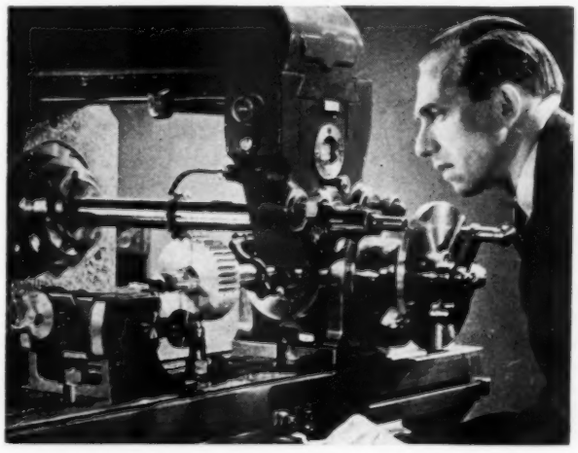
DETROIT—An Eastern Aircraft Division of the General Motors Corporation has been formed for the purpose of undertaking manufacture of fighting planes for the Navy. Included in the new division will be the Fisher Body plants in Tarrytown, N. Y., and Baltimore, the Delco-Remy plant in Bloomfield, N. J., the Ternstedt-Trenton plant, Trenton, N. J., and the Linden Division plant, Linden, N. J. This organization is part of the corporation's program of rearranging its plants and facilities for production of war materials. L. C. Goad, who has been assistant to Albert Bradley, vice-president, will be general manager of the new division.

WILL MEET CAR SCHEDULE

The schedule of freight car production—36,000 by May 1—will be met, concludes the Railroad Advisory Committee. Priorities were granted Jan. 2 on the car program, and on continued production of a scheduled 926 locomotives. The committee, including car and locomotive builders and the railroads, estimated the program will take 1,413,893 tons of steel, 353,637 tons of cast iron, 19,985 tons of non-ferrous metals and 570 tons of rubber. As a part of the speedup, cars are being standardized. The committee urged that materials be made available for possible production of passenger cars.

ADVERTISERS PICK ATLANTIC CITY

CHICAGO—The National Industrial Advertisers Association has selected Atlantic City as the site for the twentieth annual conference. The conference will be held in the Hotel Traymore in September.



Training Films—Fifty reels of film to assist potential and employed war workers to more rapidly learn the lessons given them in vocational schools are being prepared by the U. S. Office of Education. Still shot (left) is taken from milling machine series. Other reels cover engine lathe, boring mill, drill press, and shaper operations

Rising living costs foster need for higher pay; strikes barred, rates up to government, unions

BY ROBERT COLBORN

WASHINGTON—Imminent threat of a new wave of wage demands will not be forestalled by passage of the price bill. The bill comes too late, is too weak to prevent the increases in living costs that back up campaigns for higher pay. Accelerating since Pearl Harbor, the upward price movement has driven wholesale price indices 18 percent above a year ago, food and textile prices 26 and 23 percent upward.

Already the curve of real wages, which has been rising as a result of 1941 wage increases, has begun to turn downward. The CIO has served notice that it will ask for "substantial" increases in forthcoming contract negotiations. And, while the AFL unions haven't put themselves out on that kind of limb, it's a safe bet they won't be far behind.

Fostered Labor Unity

With strikes practically debarred—by the War Labor Board agreement and, if that fails, by war-intensified Congressional and popular pressure— wage rates become essentially a matter between the government and the unions. Imminence of this issue—and of a slew of others like it—is what precipitated the whole labor unity issue late in January.

Formation at Presidential request of a six-man AFL-CIO committee provides immediately, as far as the administration is concerned, many of the advantages which would come from organic unity of the two federations. William Green, George Meany and Dan Tobin of AFL and Philip Murray, R. J. Thomas and Julius Emspack of CIO can speak for organized labor as a whole. Appointment of the committee, as regards timing at least, is the President's riposte to John L. Lewis' effort to cut labor away from the administration by creating a new united organization in which he would be the power behind the throne.

Committee Plans Own Job

FDR's scheme is based essentially on the view that labor unity can't be created by the fiat of a negotiating committee, must arise through the slow process of working together on specific issues. This is a process that the President has been nursing along all year. It began a year ago, when AFL and CIO were invited to nominate members of OPM's old Production Planning Board.

Job of the committee is about what it wants to make it. Present conception is that it will work with the adminis-

tration in the formulation of broad policies on such issues as wage procedure, adaptation of social security to the war, conversion of industry and labor priorities when they come, probably late this year.

Disputes Left to Labor Board

Consideration is being given to the appointment of a parallel group representing management. Such a set-up would give both elements in industry a voice at a higher level of policy-setting than is reached by the industry advisory committees attached to the industrial branches.

The six-man labor committee will not concern itself with settlement of specific jurisdictional disputes between the two federations. These will go to the War Labor Board. But, inevitably it will start thrashing out the underlying problems of overlapping jurisdiction that stand in the way of amalgamation.

Lewis May Form New Group

Big question mark as we go to press is John L. Lewis' next move. Very likely he doesn't know himself. Lewis lieutenants are puzzled and jittery. They admit that the mine boss has taken a beating for the moment, but they're wondering if he won't spring another sensational coup d'etat.

One possibility is that he might join with die-hard elements in the AFL to form a new labor group. Hutchinson's carpenters and even Tobin's teamsters are mentioned in this connection. Alternatively, Lewis, in a big gesture of reconciliation, could return to CIO-New Deal orthodoxy, wiping out his hatchet units—District 50 of the Mine Workers and Denny Lewis' construction workers.

ASKS AID FOR WAR UNEMPLOYED

WASHINGTON — The President has asked Congress to put up $300,000,000 to help workers thrown out of jobs by conversion to war work. However, the scheme would be applied to all unemployed workers—whether their unemployment resulted from the war or not. It is essentially a move to raise the level of unemployment insurance payments generally.

Payments to unemployed workers now vary all the way from $3–4 per week for three or four weeks up to $20 for 24 weeks, depending on the state. If approved by Congress, the President's plan will raise all weekly payments by 20% and will lengthen the time of payment to a uniform 24 weeks—with the federal government bearing the extra cost. Workers would have to agree to accept training for war jobs if such training is available.

LARGE RISE IN TRUCK ORDERS

CHICAGO—Bookings of electric industrial trucks totaled 345 units, worth $1,472,336 during December, as reported by the Industrial Truck Statistical Association. This compares with 135 units with a value of $487,879 in November.

Staggering Arms Appropriations Would Give U. S. Supremacy in Sea and Air; Speed Big Bombers

WASHINGTON—First two bills in Congress for arms since Dec. 7, each bigger than any in history, call for supremacy on and under the sea and in the air.

One is the fourth supplemental appropriation for 1942, in the amount of twelve and a half billion dollars, for the production of airplanes. The other carries an eighteen billion dollar fund mostly for fiscal 1943, for building war ships and to increase the Navy's rate of plane production for the air arm from 500 a month to 1,500 a month, or 18,000 a year—equal to our entire airplane output a few months ago.

Arnold Stresses Big Bombers

The House Appropriations committee in its report, and Gen. H. H. Arnold, Chief of the Air Forces, in his testimony, strongly emphasized the need for fast production of four-engined bombers, leaving no doubt of their importance in the conduct of the war.

The airplane bill calls for: $933,000,000 for conversion of auto plants to airplane production and for new assembly plants, previously stated as from six to ten, in the interior of the country; $9,041,373,090 for the procurement of 33,000 complete airplanes, of which 23,000 will be tactical and 10,000 training types; $680,242,180 for Signal Corps—mostly radios for planes, communications facilities and locating devices; $1,547,948,529 to the Ordnance Department for airplane guns; $323,308,675 to Chemical Warfare Service probably for incendiaries, flares, smokescreen, etc. The total is $12,525,872,474.

Additional Money Necessary

This airplane program does not entirely meet the Army's share of the total 1942 60,000 planes and 1943 125,000 planes goal set by the President. It does tie in with it, and is a preliminary step, but additional appropriations will be necessary to complete it.

This twelve billion dollar fund will (1) prevent a decline in production that would occur next August when existing orders begin to run out, (2) provide plane orders to fill up new plants which will be in production by then, and (3) increase capacity for the production of heavy bombers.

General Arnold explained that the 24-hour seven-day week will reduce the amount of time a given plane occupies a plant and will greatly expedite total production.

Army Warned to Watch Costs

Entirely new construction will be limited mainly to bomber assembly plants and plants for the production of explosives and incendiaries.

The Committee, in reporting the bill to the House, called upon the War Department to keep an eye on costs. One source said that we are paying 50 percent more than the British are for planes. The Truman Committee investigating war profits says that heavy bombers cost $477,000 and up; pursuit ships as much as $120,000 and primary trainers $13,500; engines for heavy bombers are $12,000.

Half of Sum for Ship Construction

The $17,722,565,474 Navy appropriation is divided: $4,292,225,500 supplementary for 1942, and $13,430,339,974 for fiscal 1943. The total includes $8,206,760,385 for new ship construction outside of small non-combatant boats, which is 46 percent of the total. This amount is to continue work on construction already authorized, which includes 400 local defense vessels, 800,000 tons of auxiliary vessels, and 150,000 tons of combatant ships.

Renews Battleship Debate

The fund also covers completion of the program of 1,799 auxiliary vessels recently approved, and many other projects. It is unofficially noted that the 150,000 tons of combatant tonnage includes battleships yet to be laid down. If this is so it will incur further controversy over whether such expensive ships should be built in face of their vulnerability to airplane attack.

Revision of these Naval appropriations to astronomical sums is the result of entry of the United States into war. A considerable proportion of the increase is due to rising wage and materials costs.

ROUND UP IDLE MACHINES

WASHINGTON—The campaign by the Army Navy Munitions Board to round up idle machine tools is bringing satisfactory results, the War Department announces, although no figures are given. The Board writes to persons and firms, who are shown by the Government's survey to have idle machine tools, asking cooperation by releasing specified equipment for war work. The Board asks for a description, the selling price and a photograph, if possible. One reply offers to loan or sell a machine at the government's price.

PUT POWER PLANTS ON BARGES

WASHINGTON—Emergency power plants, capable of generating 30,000 kw., are being built for the War Production Board. They will be installed on four barges for towing to war plants and cities where needed to supplement regular power supply. Similar power plants are reported under construction for the Navy, but will be mounted on railroad cars.

Air Corps Gives Industry 24-Hr. Service Every Day

DETROIT—The Central Air Corps Procurement District Headquarters, 8505 West Warren Ave., ask all plants within its jurisdiction to clear problems in connection with aircraft manufacture without delay. A competent staff is maintained on 24-hr. duty, seven days a week. No problem should be left hanging merely because it arises at night or over the week-end, because the production program is too serious to be held up in any phase, regardless of how small the detail. Sub-contractors, especially, should understand that they can get help at any time. The telephone number at Detroit is Hogarth 8730.

The Central Procurement District has jurisdiction in the 27-state area lying between the Alleghenies and the Rockies, from the Canadian border to the Gulf. Contracts are prepared at Wright Field, but all other phases of the procurement program are handled out of Detroit.

Functions Cover Priorities

Functions of the Detroit office are: (1) priorities on materials, machine tools, cutting tools, jigs, fixtures and gages required in manufacture of aircraft materiel, also maintenance equipment and materials, (2) inspection, (3) air-plant protection, (4) production engineering, (5) experimental engineering, (6) industrial planning, (7) property accountability—matters connected with Lend-Lease. This appeal is made with the approval of the commanding officer, Col. Alonzo Drake, who is of the opinion that many contractors and subcontractors have not realized that constant service is available at Detroit.

OPA Establishes Machine Tool Price Ceiling At Level of Oct. 1; Schedule Is All Inclusive

WASHINGTON—Explaining that voluntary price control has not been adequate to meet the stimulus of the mounting backlog of orders for machine tools, the Administrator of the Office of Price Administration has issued a ceiling schedule, effective Jan. 20, setting prices on new machine tools at the level prevailing last Oct. 1. Builders are required to file maximum prices with OPA by Feb. 15.

The schedule is broad; it includes all machines for the cutting, abrading, shaping, and forming of metals. In addition to lathes, planers, milling machines, etc., it covers such equipment as metal presses, shapers—machines not usually thought of as machine tools.

Brought on by War Entry

Any doubt that a ceiling schedule would be put on new machine tools faded when the United States entered hostilities. Soon after that came the President's program of planes, guns, ships and tanks, of such vast scope that it promises to take every pound of U. S. industrial material and energy. Then came actual appropriations: twelve billion for airplanes and all that goes with them; and eighteen billion for Navy ships. More billions are coming.

Production of machine tools is now at the rate well above $80,000,000 per month. Total production in 1941 was $775,300,000. Unofficial estimates have been published that this figure will be more than doubled to over $2,000,000,000 in 1942. But disinterested estimates are $1,500,000,000.

Spokesmen for the industry here say that they will cooperate; that they hope it does not take too long for OPA to make upward price adjustments on account of cost increases. They feel that the industry can come nearer to meeting the demand for tools than is generally supposed, and that the War Production Board's main problem is to get plant lay-outs ready so that definite orders can be placed for tools.

War Brings Huge Backlog

Many of those now being produced are going into pools, where they are idle. The pool for the 500 bomber program was overstocked, and some of the stock was released to other uses.

All this metal work, and all the machine tools it takes to do it, must pyramid up from machine tools. Thus machine tools are the priming cap of the world war, and that is why the backlog of orders, which was already growing, despite all efforts of the industry, is still mounting higher and higher.

Builders' Suggestions Followed

Glancing back over the machine tool price record: OPA, on last May 6, sent a letter to the industry asking that builders maintain prices as of that date. Some advances were made, and the request was repeated on August 18. "Indications of price unsettlement" caused Mr. Henderson to call a meeting of machine tool builders Oct. 22 to discuss the advisability of a price ceiling. These discussions were continued at a second meeting Nov. 17, at which a tentative schedule was talked over.

Jan. 7, 1942, about 300 manufacturers met with OPA and were informed of the proposed ceiling. Jan. 21, the new schedule, No. 67, was issued. It "embodies many of the suggestions made by various members of the industry." OPA price order No. 1 was on used machine tools, last February 17.

Prices Set on New Developments

Order No. 67 provides that if there was no list price as of Oct. 1, the maximum price is the last price at which a similar tool or extra was sold between Jan. 1 and Oct. 1. A special section of the order explains the method of determining the maximum price for newly-developed equipment.

Existing price arrangements in outstanding contracts between machine tool builders and Army, Navy and other Government procurement agencies, are not disturbed by the schedule. But deliveries under all other contracts must conform to the new maximums.

Contracts for delivery of equipment after more than nine months from date may include a provision giving the seller the benefit of any changes that may be made.

British-Combine

Bombs for Berlin—British workers machine and inspect 500 lb. bomb cases. Production of 500 lb. bombs for the Royal Air Force has been greatly accelerated in recent months

Press Association

Men Working Together — Members of the War Production Board are, clockwise, left to right: Price Administrator Leon Henderson, Under Secretary of the Navy James V. Forrestal, Secretary of Commerce Jesse Jones, Secretary of Navy Frank Knox, War Production Chief Donald M. Nelson, Vice President Henry A. Wallace, Under Secretary of War Robert P. Patterson, and William S. Knudsen, who is in charge of War Department Production

Contract Distribution Branch Increases Local Offices to 113

WASHINGTON—Seven new contract distribution offices have been established to help qualified manufacturers obtain war work. These bring to 113 the number of local agencies operated by the Contract Distribution Branch, Production Division of the War Production Board. The offices and managers are:

Camden, N. J.—300 Broadway, Frederick Cohen.

Canton, Ohio—205 Market Ave. S.

Decatur, Ill.—132 S. Water St., E. W. Bassett.

Huntington, W. Va.—West Virginia Building, J. A. Kennedy.

New Haven, Conn.—152 Temple St., C. A. Newton.

Peoria, Ill.—Alliance Building, R. W. Pritchard.

Trenton, N. J.—32 E. Hanover St., C. S. Maddock.

MACHINE SHIPMENTS HIGH

NEW YORK—December shipments of products to builders of ships, airplanes, tanks and guns were the largest in the International Machine Tool Corp.'s history and more than three times as great as shipments made in Dec. 1940. Dollar value of machine tools delivered in December was $1,373,192, compared with $455,871 in Dec. 1940. Net sales for the twelve months of 1941 were $11,414,416. This is an increase of 125.6 percent over 1940 deliveries of $5,059,952.

ALLOWS USE OF TURBINE PLANS

EAST PITTSBURGH—To speed production of marine turbines, gears and auxiliary apparatus for the Navy and the U. S. Maritime Commission, the Westinghouse Electric & Mfg. Co., has authorized the Joshua Hendy Iron Works of California to use Westinghouse plans and processes. Hendy engineers will observe manufacturing operations in the Westinghouse South Philadelphia Works, where propulsion equipment is being made for more than one hundred Navy fighting ships. The engineers also will be provided with manufacturing data, drawings and records assembled during 45 years of turbine production.

CARDS CONSERVE TOOLS

PHILADELPHIA—"Conservation Control Cards," telling workers how to handle a particular tool so that easier and better work is produced with longer tool work, have been developed by Henry Disston & Sons, Inc. Thirty-five cards cover cutting tools for all materials, including tool bits, files, hack saw blades, carboloy knives and cutters, and circular and band saws. Emphasis is placed on the importance of saving materials in order to make more materials available for Victory.

Surveys reveal that breakage and scrapping of cutting tools have become alarmingly high and must be reduced through thorough education of workers. Much of the working force in the war production program are relatively green hands. The Disston Conservation Control Plan shows the individual worker how to use tools, how to keep them from breaking and how to sharpen them.

Vinson Report Not Alarming; Doom War Profit Limitation

WASHINGTON — Whispering for months led to the expectation that sensational revelations would be made when Vinson's House naval affairs committee submitted its report on excessive profits. Consequently the revelation that the average rate of profit on Navy contracts is 7.99 percent fell rather flat. Impact was lessened too by the incomplete nature of the data presented. The committee dug up a good many cases of profits of 100 percent or more on contracts for a few thousand dollars and found quite a few cases of profits of 15–50 percent or so on fairly substantial contracts.

But the report made no claim that it had uncovered any general profiteering. It did point to those cases it unearthed as sufficient evidence of need for "some method of profit limitation," requirement of uniform cost accounting by Navy contractors, provision in contracts for renegotiation when profits are excessive.

Favor Negotiated Contracts

Supporting continuation of authority to negotiate contracts, the committee found that profits in general run lower on negotiated than on competitive bid contracts. It also suggested study of the British "target price" contract, in which the contractor is rewarded for savings over advance cost estimates.

Venturing into the labor field, the committee was "startled" to discover that assets of labor unions rose between the fall of 1939 and the spring of 1941 from $72,000,000 to $82,000,000. The committee recommended registration of unions and anti-strike legislation.

Walsh Wants Stiffer Bill

To put into effect his committee recommendations, Rep. Vinson is drafting a new bill which would limit, probably to 7 percent of the gross the profits which might be averaged by a contractor over a period of time rather than on individual contracts. Senator Walsh, chairman of Senate naval affairs committee, is talking of a stiffer bill limiting profits on any one Navy contract to 5–6 percent.

Neither of these measures is given much chance, though an attempt will be made to insert them in the next tax bill by amendment on the floor. The administration, however, would rather stiffen up the general excess profits tax than impose special disabilities on war business.

WOMEN JOIN ARSENAL WORKERS

WASHINGTON — Watervliet arsenal, which makes cannon, is hiring women on jobs not previously open to them. They are engaged as toolkeepers and gage checkers, replacing men put on other jobs. Only 15 or 20 women are employed, but the number may be increased.

INSIDE DETROIT

War contracts call for unified, total production. Auto industry plans pooling of toolroom facilities and idle machine tools. Council also facilitates subcontracting. Interchange production and tooling data

BY RUPERT LE GRAND, DETROIT EDITOR

DETROIT—All sectors of the automobile industry are joined together in the task of effectuating a four-point plan for achieving maximum war production in the shortest possible time.

The plan is functioning. Policies are established. The job now is to carry out those policies in the drafting rooms and shops. How well the plan works in detail will be largely a secret until the war is over, unless the War Production Board is dissatisfied with results.

Kanzler Calls for Suggestions

Ernest C. Kanzler, chief, Automotive Section of the War Production Board, bluntly told the Automotive Council for War Production that he means to carry out his responsibilities vigorously and will call upon management, labor or any other group for sound suggestions. But joint management-labor advisory committees, such as the defunct Ching committee, have given way to lines of direct action. Kanzler is establishing a technical staff in Detroit.

The four-point plan of the Automotive Council for War Production recognizes that competitive conditions ceased to exist with the demise of the automobile business. Contracts in hand or in prospect require all-out retooling and production effort of unparalled proportions. Individual responsibility and teamwork must be blended in a new manner, but without discarding the framework of customary methods of doing business. Details of the plan are:

ATDA Correlates Information

1. Tooling Information Service. Retooling existing machinery and providing new tools for a large portion of the hundreds of millions of dollars worth of war equipment required in 1942 will be a major effort. All toolrooms will participate.

To correlate information on tooling service available in more than 1,500 shops, the Automotive Tool & Die Manufacturers will expand an existing service. ATDA will survey the industry to provide: (a) complete information on equipment, (b) current information on tool hours available and (c) requirements in classified tool hours. The service will bring together tooling customers and idle tool facilities. Actual employment of such facilities is to be subject to negotiation between the parties concerned.

Under this plan Ford can call on General Motors, or vice versa, to make tools if machine hours are available. Normal competitive conditions surrounding model changes obviously would ban such practices. Before this program can be made effective, management and labor must each revamp their thinking on a number of questions, such as worker training, pay for toolroom trainees versus journeymen, staffing plants so that no idle machine hours exist.

2. Machine Tool Listing Service. The Automobile Manufacturers Association has taken responsibility for compiling classified information on all machinery and equipment not engaged in war production. Besides idle tools, machinery to be listed will include equipment allocated to future war production and that now working on replacement parts.

Will List 150,000 Machine Tools

Negotiation for use, sale or lease of such equipment will be conducted by companies concerned. AMA expects that 150,000 out of 350,000 machine tools possessed by 1,500 plants in auto industry will be listed. Data will be tabulated on type, size and location of each tool. Firms outside the industry also may negotiate for equipment.

3. Contract Distribution Service. Shopping lists for an immense volume of work required by prime contractors were distributed to the 800 industry executives attending the full-dress meeting of the Automotive Council for War Production, Jan. 24. This activity will further develop as prime contractors digest the mass of blueprints flowing in.

Sub-contractors Must File Data

To facilitate bringing firms together, prime contractors are asked general character of work for which sub-contracting sources are wanted, description of items and type of equipment needed to produce the pieces. Sub-contractors will report: types of machines and facilities available, types of work sought and previous experience and present war work.

4. Technical Information. Product sub-divisions of the council have been set up for aircraft engines, airframes, ammunition, artillery, small arms, marine equipment, military vehicles, propellers and tanks. They will pool information on up-to-date production and tooling methods. Patents may be freely interchanged, as is done by the Automobile Manufacturers Association.

Many Associations Cooperate

Production men and Society of Automotive Engineers technical talent will work together. Manufacturer will retain full authority over the tooling and production methods chosen for a parti-

Final Inspection—Aluminum pistons for Wright Cyclone aircraft engines flow from production lines of the Hudson Motor Car Co. to this inspection room. Complete check is made here to see that pistons meet specifications, including weight which must be between 4.92 and 4.96 lb. per piston

WILLYS CONVERTS TOTALLY

TOLEDO — The Willys - Overland Motors, Inc., is the first automobile firm to achieve 100 percent conversion from peace-time manufacture of motor vehicles to all-out production of war materials. The Willys factory is turning out reconnaissance cars (jeeps), quarter-ton scout cars, breech housings, shell and recoil cylinders.

cular undertaking, but he will have the latest information from all firms doing similar work.

All activities will be carried through by the Automotive Council for War Production, New Center Bldg., Detroit. These associations are cooperating: Automobile Manufacturers Assn., Automotive Parts & Equipment Mfrs. Assn., Motor & Equipment Mfrs. Assn., National Standard Parts Assn., Automotive Tool & Die Assn. and the Society of Automotive Engineers.

Prejudices Must Subside

Time will tell whether the auto industry's war plan is written in broad enough fashion to accomplish the task demanded by government. Long-standing prejudices in methods of plant operation or handling labor may interfere with prompt action. Although operation of the plan will actually be carried out in the shops, will committee action cut cleanly through existing barriers to all-out production? Labor hasn't said much, since the Kanzler appointment. Opinion in some quarters leans to the view that some time must elapse before all factors in the program will work together effectively.

Allies Form Joint Munitions, Shipping, Materials Boards

WASHINGTON—Creation of a three-way liaison mechanism to coordinate the Anglo-American war job culminates and brings into the open a gradual evolution of many months standing. Three joint committees are established. One, predominately military, is a munitions allocation board. Its job is, if in a given month U. S. and United Kingdom produce say, 5,000 airplanes, to decide how many shall go to Libya, how many to the Indies, how many to Russia.

A second committee is to control the operations of the pooled shipping facilities of this country and its allies.

International Allocation of Materials

The third is the most important to industry. It is a materials board which has the stupendous job of taking all the industrial raw materials produced by the United Nations (except Russia) and allocating them to the factories of this country or that. It is headed by William Batt—a natural candidate since he heads the requirements committee of WPB, which does on a national scale much the job that the new body does on an international level, and also heads WPB's materials division.

In the past the munitions production efforts of this country and Britain have been more or less correlated under the Lend-Lease program, by negotiations between U. S. government agencies and the dozen or so commissions in this country representing the various British ministries. In theory, each British commission would submit requisitions for things wanted to the Lend-Lease Administration, which would approve or disapprove them and then parcel them out for procurement to an appropriate U. S. agency.

Lend-Lease Becomes Bookkeeper

Inevitably, however, the British agency tended to negotiate first informally with its opposite number in this country—the Army, the Procurement Division, the Surplus Commodities Corporation, etc. The formal requisition tended to become nothing but a formality. The new set-up recognizes this situation and reduces the Lend-Lease Administration to a mere bookkeeping agency keeping track of the transactions.

There are still two big holes in the set-up. More or less by mutual consent, Russia is left outside. The Soviets apparently have no desire to pool their resources with ours. Materials interchange will be determined by negotiations between USSR on one side and U.S.-U.K. on the other.

British Reorganize Production

The other blank spot is production. No machine has yet been set up to decide on such matters as whether Britain should concentrate on the production of fighter planes and this country on bombers (reportedly such a rough agreement was made some time ago). Presumably some such joint group will be established when the British complete a reorganization of their production machine similar to that which, in this country, made Donald Nelson production boss.

WAR ORDERS IN BRIEF

PREFERENCE RATINGS—All preference rating certificates issued by the Division of Priorities, Office of Production Management, are formally validated by James S. Knowlson, Director of Industry Operations, War Production Board.

ALUMINUM—Supplementary Conservation Order M-1-e prohibits use of aluminum in any manufacture except on war contracts and a long list of specified items: replacement radio condensers, orthopedic equipment, commercial aircraft with A-10 or higher rating, welding rods and pistons for heavy trucks, diesel, tractor engines.

CADMIUM—General Preference Order M-65 restricts deliveries of cadmium to preference ratings of A-10 or higher and to specific orders of the Priorities Director. Order M-65-a prohibits use in a long list of items.

CHROMIUM—An amendment to General Preference Order M-18-a prohibits any person from melting more than two tons of ferrochrome without specific authorization of the Priorities Director.

COPPER—Supplement No. 1 to Conservation Order M-9-c directs that no copper may be used in shoe eyelets after March 31. Until that date, production must be limited to consumption to April 1. The order will save enough brass to make 1,000,000 shell cases per year.

CRANES—Preference Rating Order P-5-b assigning preference ratings to manufacturers of cranes and hoists is extended to May 1.

ELEVATOR REPAIRS—Amended Preference Rating Order P-72 permits use of an A-3 rating for materials needed to manufacture repair parts for elevators, escalators and dumbwaiters.

MACHINE TOOLS—Preference Rating Order P-77 assigning an A-1-c rating to materials needed in rebuilding machine tools is extended to April 1.

NICKEL—Conservation Order M-6-b prohibits use of nickel in a long list of items after April 1, and curtails such use until then 50 percent. Limitation Order L-28 curtails use of nickel, brass and copper in incandescent lamps 25, 20 and 20 percent, respectively, during February, March and April.

RADIOS—Limitation Order L-44 cuts production of radios until April 27 by 45 or 35 percent of the average monthly output in the first nine months of 1941. Size of cut depends on manufacturers volume. Phonographs and radio phonographs are included.

TIN, LEAD FOIL—Limitation Order L-25 on tin and lead foil is revoked as Conservation Orders M-43-a and M-38-c provide necessary restrictions.

WELDING CLASSES—Preference Rating Order P-92 grants priority assistance in obtaining steel plate and welding electrodes to defense training classes for welders under the U. S. Office of Education. Application must be made through the Office of Education on form PD-183.

WARTIME WASHINGTON

Men stay although OPM is ended. Authority backs up Nelson's aides, who must speed war program or lose positions. DIO converts industries to munitions production. Kanzler gets power

By BLAINE STUBBLEFIELD

WASHINGTON—To say that Donald Nelson wiped out the OPM can give a misleading impression. He abolished the OPM council—the group made up of Knudsen, Hillman, Stimson, and Knox. All four are now members of the advisory War Production Board. Functions of the council had been progressively taken over by the former SPAB and the Industry Branches.

But the bulk of the war organization is structurally unchanged. In the main, the same men sit at the same desks. Difference is that now they have real authority, are backed by Nelson's sweeping executive order. If they are able to use it, they will stick. If not, they go.

One division was abolished. Floyd Odlum's never very effective Division of Contract Distribution becomes a subordinate bureau in the Production Division, will be headed by Odlum's former deputy, Walter Wheeler.

Priorities Scope Enlarged

The Priorities Division, now headed by James S. Knowlson has its scope considerably enlarged under the new name of Division of Industry Operations. It is responsible for conversion of the manufacturing industries; in order to do this job, it gets control of all the industry branches for these industries. The commodity branches, dealing with the raw material industries, head up under the Materials Division.

J. S. Knowlson

As head of the War Production Board's Division of Industry Operations, James S. Knowlson has overall charge of converting American industries for war products. He is president and chairman of the board, Stewart-Warner Corp. and was brougt into OPM at Donald Nelson's request on Sept. 16, 1941 as deputy priority director. Recently he served as acting director until WPB was established

Requirements Committee Allots Supplies

Biggest change, and one which ties in to the new international supply organization (see p. 84h), is the creation of the Requirements Committee. Headed by material chief William Batt and made up of representatives of the services, lend-lease, economic warfare and the Civilian Supply Division, this committee will have a job that's never been handled at all in the past. It will insist on getting from Army, Navy, Lend-Lease and Civilian Supply, reasonably firm estimates of needed goods, reduced to terms of raw materials. Balancing these against the available supplies of materials, it will decide how much of each material is allotted to each of these broad categories of use. These decisions will then guide the practical workings of the priorities system.

Auto Conversion Centered in Detroit

The story of the conversion of the auto industry to war production is, from now on, a story with a Detroit dateline. Symbolizing the intention to fasten a firm governmental hand on the hour-by-hour management decisions of the industry, the War Production Board's automotive branch has been moved bodily to Detroit. Ernest Kanzler, new chief of the branch will leave only an assistant and a skeleton staff in Washington.

Just as the industry was congratulating itself on having escaped the clutches of the Reuther plan, the metamorphosis of OPM into WPB put the industry into the hands of what may well be an equally ruthless boss—the government. Kanzler has been given, as to the auto industry, all the powers that Nelson himself has, and that means all that some of the smartest men in Washington can pack into an executive order.

Control Kept From Labor, Management

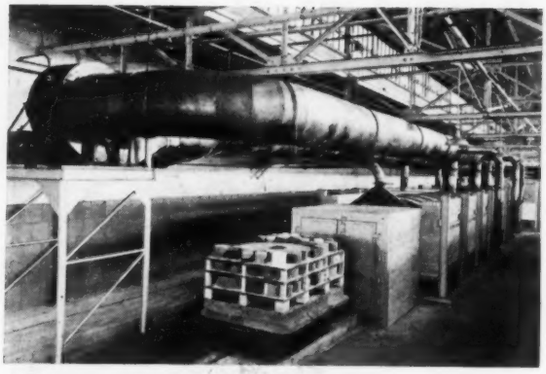
There's no element of labor control in the new set-up. Donald Nelson is determined that neither labor nor management have the final say. Both are advisory to the real boss—the automotive branch of WPB. Kanzler has what amounts to work allocation power in his instructions to "make recommendations" to Army and Navy as to the placement of contracts. How far he will go in pooling of facilities is a matter between himself and Nelson. He has instructions "to take whatever steps are necessary to bring about full utilization of the industries mechanical facilities."

Conversion Czar—Ernest Kanzler, appointed by Donald Nelson to head the automotive branch of the War Production Board, is in Detroit with full authority to convert the auto industry to war production. Early in January, Kanzler, president of the Universal Credit Corp. and former Ford production vice president, headed defunct OPM's Automotive Branch

Parts, Truck Production Held Over

Meanwhile, the auto plants still have two jobs surviving from the days of peace—replacement parts for passenger cars and production of heavy trucks. Intention on parts is to produce at a high rate for the next five months, building up a sufficient backlog of parts to take care of needs for the remaining life of cars now on the road. Parts builders have been authorized to build three times as many replacement parts the first half of this year as they did in half of 1941. They are given an A-10 rating to get materials to do this.

Truck output for civilian use in March will be permitted at a rate 34 percent greater than in the same month last year and will be aided by an A-3 rating. Truck parts, for the first quarter, are to be built 20 percent faster and get the same priority aid. Trucks will be sold to dealers without tires, will be rationed to users.



More Grinding Wheels—New continuous kiln (left) will increase production of vitrified grinding wheels 30 percent at the Macklin Co., Jackson, Mich.

Scrap Shortage Big Hurdle For War Production Program

WASHINGTON—One of the most difficult hurdles of the war production program is the scrap metal situation. Lack of scrap iron and steel will cut 1942 production of steel below the record production of 1941. Non-ferrous scrap is equally as tight. In fact some officials feel that the controlling factor in this year's arms output will be scrap.

One factor cutting sharply into the scrap supply is the halt in auto production. Automobile factories for a long time have been the largest source of supply. Until they get fully underway on the arms program, they will supply little to the market.

Exports Decrease Stocks

Shipment out of the country of steel ingots and tanks and other arms made of metal is also a controlling factor. Wrecked and obsolete tanks, trucks, planes normally form a source of supply, but they do us no good in Libya, Asia, Europe. Likewise, steel and other metals shipped to other countries and machined add nothing to our stock piles.

To speed and to concentrate the drive for scrap metals, Donald Nelson has placed the collection of all scrap, including iron and steel, under the Bureau of Industrial Conservation, headed by Lessing J. Rosenwald. Rosenwald's first move was to intensify the drive to empty the nation's auto graveyards.

An estimated four or five million old cars in auto graveyards will yield between 3,000,000 and 3,750,000 tons of scrap. Other drives to augment the iron and steel scrap pile are salvaging old street car and railroad rails, obsolete machinery and farm and home scrap.

Segregation Aids Program

A most important step in whipping the scrap situation is proper segregation and classification of scrap. High grade alloy scrap properly classified is far more valuable and of greater use in the war program than the same quantity of mixed scrap which must be used at it's lowest grade.

W & S RECEIVES NAVY AWARD

CLEVELAND — The Warner & Swasey Co. last week received it's Navy "E" pennant and Bureau of Ordnance flag in recognition of outstanding efforts in the production of ordnance material vital to our national war effort. Presentation of the award was made by Rear Admiral Henry V. Butler, former commander of the aircraft battle force of the U.S. Navy. Frank A. Scott, former president of the company and chairman of the War Industries Board of World War I presided.

VACANT FACTORIES WANTED

WASHINGTON—Information on all available vacant industrial buildings is being collected by a recently formed industrial building utilization section, Plant Site Board of the War Production Board. This information will be made available to the Procurement Division of the Army and Navy so that they may cooperate in placing war contracts in such a way as to utilize idle buildings.

This action will accomplish two purposes: start production immediately or in a relatively short time as it won't be necessary to erect a new building, and a large amount of essential materials that would be needed for a new structure will be saved for war purposes.

Frederick A. Kimmich, Detroit industrial engineer, is in charge of the new unit. He asks owners of usable vacant factory buildings to send information on land area, floor area and other plant data to the Plant Side Board, Social Security Building, Washington.

ARMY ELIMINATES ALUMINUM

WASHINGTON—Elimination of aluminum from Army field range equipment, pack saddles, ration boxes and coffee filters is announced by the War Department. The decision made by the Quartermaster Corps will effect a saving of over 16,000,000 lb. of aluminum. Henceforth field ranges and stock pots will be made of steel, coffee filters are to be eliminated for the duration and the frames of pack saddles will be plywood and plastics. Aluminum saved from pack saddles alone will amount to 70,000 lb. this year.

PRP Aids Small Firms Needing Scarce Materials

WASHINGTON—To facilitate getting a moderate quantity of scarce materials into the hands of small businesses, the Priorities Division has worked out a modified form of the Production Requirements Plan. Under the new scheme, as under the regular PRP, a manufacturer is granted a priority rating which he is permitted to use on purchases of specific materials up to a specified amount in any quarter.

Thus, a firm might get a rating of A-3 applicable between Jan. 1 and March 31 on purchases up to 10 tons of steel, a ton of lead, 3 tons of rubber, etc. It is not an allocation because there is no guarantee that the manufacturer will get his full quota; it might happen in some months that there isn't enough lead to fill all the A-3 orders. Nevertheless, such a rating is much handier than individual PD-1 ratings which have to be applied for each time an order is placed.

Red Tape Shortened

The Modified PRP, which is available only to manufacturers whose annual volume of business is less than $100,000, introduces three new features:

1. There is less red tape. Instead of the multi-page PD-25-a application form required under PRP, a simplified one-page form has been developed known as PD-25-x. A special Small Business Section has been set up in the Production Requirements Branch of Priorities Division to handle these applications and it hopes, at any rate, to give high speed service.

2. The criteria for the assignment of ratings have been adjusted to the special needs of small business. In addition to the factors regularly taken into account—importance of the product to war or essential civilian needs, maintenance of employment—attention will be paid to the disadvantageous purchasing position of small producers and to the location of plants in areas widely stricken by priorities unemployment.

May Lead to War Work

3. In order to aid in the absorption of small firms into the war effort, the PD-25-x form provides for the listing of the manufacturer's power-driven machinery. This information will then be available to the Division of Industry Operations in assignment of war work.

The plan is not intended to keep small industries going indefinitely just because they are small. It does aim however to help bridge over the difficult period of conversion to war or essential civilian production.

The information obtained from small manufacturers will give a picture of the needs and uses of materials. As this picture is filled in, priority assistance can be granted with increased accuracy, graded according to the importance of the product.

Canadians View U.S. Dive Bomber Contract As Indication of Hemisphere War Cooperation

OTTAWA — Consolidation of United States-Canadian war production took tangible shape this week when the biggest single war contract yet awarded in Canada, came from the United States government. It is a $60,000,000 contract to Canadian Car & Foundry Co. for about 1,000 latest-type Curtis navy dive bombers.

Canadian Car & Foundry Co. is wholly Canadian-controlled. The company, officially pronounced the most successful and efficient Canadian aircraft producer, is completing, at the rate of 35 units a week at its Fort William plant, a British government contract for 600 Hurricane fighters. It employs from 4,000 to 5,000 workers at Fort William and another 1,000 at Port St. Charles, Montreal.

Deliveries Will Start in Late '42

The dive bomber contract was placed through Minister C. D. Howe's Munitions and Supply Department. Bulk of the fabrication will be carried out at the lakehead city, the machine tool work being done mostly at Montreal. Conversion of jig and tool equipment for the bomber job will take some time but deliveries are expected to start before the end of the year. The contract will not be completed before 1944.

The contract comes at the time Canadian aircraft firms are wondering about new orders. Informal assurance is given that Canadian Associated Aircraft—organized by five companies before the war started to build Hampden bombers for Britain—will get more orders when the bomber job is completed. Government-owned Federal Aircraft will be taken over by Vickers of Montreal when it finishes work on Avro-Ansons. Ottawa Car and Aircraft Co. is laying off men by the hundreds pending new orders.

See Real Hemisphere Cooperation

The U.S. dive bomber contract for Canada is regarded by Ottawa as much more tangible indication that continental integration of war production may become a reality than Washington's "hemisphere economic union" plan disclosed in connection with the Pan-American conference. Ottawa officials felt that the plan was too broad to be practical.

They saw little chance of tariffs being removed from more than war supplies and discouraged an assumption in business circles that the proposal for a common exchange medium for war trading would bring parity between Canadian and U.S. dollars. Their view is that the exchange differential will remain for non-war purposes and that Canada still will have to peg the value of the Canadian dollar even if the exchange plan is adopted. Restrictions on U.S. exchange might be relaxed.

Fresh restrictions on the use of scarce materials by civilian industry—in some cases even by war industry—indicate how far Canada is prepared to go in treating her supplies of these materials as common stockpiles. One of the latest curtailment orders forbids use of wrought and cast bronze metal for government contracts and wartime industries and housing as well as for builder's hardware, furniture and other purposes. Shipbuilding and the interior parts of locks are the only exceptions from the order which becomes effective March 1.

Metal Use Cut Further

To the long list of household and other appliances requiring metal on which production was stopped Dec. 31 are added electric grills, coffee-making stoves and tea-kettles, other electric utensils. Manufacture ceases Jan. 30 and manufacturers have till April 29 to dispose of their stocks. Production of electric irons, toasters, fans is cut to 50 percent of 1940 output.

The automobile situation has been clarified by a ruling that production of passenger cars, which was to halt March 31, is to end when current inventories of fabricated parts are exhausted.

Ignore Canadian Controls

Canadian officials claim that some Washington authorities have not yet got around to treating materials which Canada has to secure from the United States as common war resources. They say that in some quarters Canadian requirements are looked upon much in the same way as those of a single U.S. war plant—that Canada's own allocations and priorities control is not taken into account nor the full extent of the Canadian war industry.

NAMES in the NEWS

Frederick G. Schranz has been appointed divisional vice president, Baldwin-Southwark Division, Baldwin Locomotive Works. Other divisional vice presidential appointments were: Haldwell S. Colby of the Locomotive Division, Frank K. Metzger of Standard Steelworks Division and Norris H. Schwenk of the Cramp Brass and Iron Foundries Division. Amos G. Cole and Lewis W. Metzger were named works manager and production manager, respectively, in the Locomotive Division.

Don R. Berlin has joined the General Motors Corp. to assist in aircraft development and production under the expanded war program. He had been director of military engineering for the Curtiss Airplane Division, Curtiss-Wright Corp.

L. H. Bittner was appointed director of purchases, Allegheny-Ludlum Steel Corp., succeeding E. L. McGraw who takes charge of a newly created scrap and salvage department. Mr. Bittner will be assisted by N. W. Hayson who was named purchasing agent.

James D. Black has become general manager, Loring Coes Co., succeeding the late William A. Underwood. Mr. Black was vice president and eastern sales manager, Murray-Black Co.

J. O. Ellison, with Smith Booth Usher Co. since 1938, becomes sales manager, Fray Machine Tool Co.

George Eglinton, sales manager, Wickman Corp., has resigned to return to his former position as vice president and general manager, Lincoln Park Tool and Gage Co. The change came as a result of the greatly increased demands put upon the Lincoln Park company by the new Victory Program. T. B. Carpenter, formerly associated

Baldwin Vice President

F. G. SCHRANZ

Purchasing Heads for Allegheny-Ludlum

L. H. BITTNER

N. W. HAYSON

PRESIDENT 50 YEARS

Franklin G. Smith this week ,completed 50 years as president, the Osborn Manufacturing Co., Cleveland, Ohio. When Mr. Smith took over the company on Feb. 2, 1892, the staff consisted of one foreman, two men, two girls and three boys. Today the payroll comprises 768

with the National Automatic Tool Co., is now sales manager, Wickman Corp.

A. R. Glancy, former president, Pontiac Motor Car Co., and vice president, General Motors Corp., has been appointed an expert consultant to the Secretary of War, and detailed as a special assistant to the Under-Secretary of War. Since February 1941 Mr. Glancy had been chief of the Ordnance Division, Office of Production Management.

Wallace N. Guthrie was elected executive vice president and appointed general manager, Cuno Engineering Corp.

John R. Hoover is manager of synthetic sales, the B. F. Goodrich Co. He had been manager of rubberlined equipment sales since 1935 and is succeeded by Herman C. Klein, who was a sales engineer in the department.

George J. Keller resigned from the R. L. Crane Machinery Co. to start the George Keller Machinery Co., Buffalo.

Charles J. Hunter appointed metallurgical engineer, Carnegie-Illinois Steel Corp., will coordinate the production of ordnance materials.

Harry F. McRell recently appointed assistant manager, transformer division, Central Station Department, General Electric Co., is succeeded by Harold N. Jalonack, as manager of sales for distribution transformers and feeder voltage regulators. William C. White has been appointed director of the electronic laboratory in which will be centralized G.E.'s development activities in the field of electronics.

Victor E. Metzger, formerly with Lockheed Aircraft Corporation and Stearman Aircraft Co., is chief sales engineer, Metal Working Machinery Division, Onsrud Machine Works, Inc.

Oliver E. Mount, secretary and treasurer, American Steel Foundries, has been elected president, the Steel Founders' Society of America.

BUSINESS ITEMS

Babcock & Wilcox Tube Co. has placed James S. Anderson in the New York District Sales Office, 85 Liberty St., New York, N. Y.

Balch Morris Inc. has purchased the Rumsey Pump plant, Senaca Falls, N. Y.

Carboloy Co., Inc., has centralized its sales engineering department under K. R. Beardslee, sales manager. Martin Muhling, former special engineering executive, and Earl Glen, former Pittsburgh representative have been appointed to new positions of assistant sales managers. R. R. Preston succeeds Mr. Glen.

Copperweld Steel Co. has moved its Chicago district office to 122 So. Michigan Ave.

Forged Carbides, Inc., has appointed Luria Steel & Trading Corp., 233 Broadway, New York, N. Y., distributors.

H & O Machinery & Engineering Co. has moved to a new factory at Euclid Ave. and Esther St., Newark, N. J.

Manning, Maxwell & Moore, Inc. has engaged James H. Withers as representative working out of their Los Angeles office. Harold M. Moore, St. Louis representative, has been called for active duty with the Army as a Captain.

McKenna Metals Co. appointed Bennett Burgoon, Jr., representative at Rockford, Ill. He had been mechanical engineer, Railway Steel Spring Division, American Locomotive Co.

Moore Products Co. has moved into a new building at H and Lycoming Sts., Philadelphia, Pa.

The Norton Co. appointed R. D. Lawson salesman for the Machine Division in New England. He succeeds W. E. Wickstrom who takes over sales engineering work at the main office in Worcester, Mass. James K. Stevenson and Paul F. Sparrow are salesmen for the Refractories Division with headquarters in Chicago and Pittsburgh, respectively.

Anton Smit & Co., Inc., distributors of industrial diamonds and diamond tools are moving to new offices at 333 West 52nd St., New York, N. Y.

Spaulding Fibre Co., Inc., has moved its New York office to 233 Broadway.

OBITUARIES

Frederick B. Jacobs, 62, editor of *Abasives*, died Jan. 20 in Cleveland.

Albert J. Jameson, 79, for 20 years director, Worcester Boys Trade School died Jan. 16 in Worcester, Mass. Previous to joining the Trade School staff, he was a master mechanic and mechanical engineer for the American Steel & Wire Co.

G. Cook Kimball, 62, executive vice president, United States Steel Corp. of Delaware, died recently in Chicago. In 1932 he became vice president in charge of operations, Illinois Steel Company. Elected executive vice president, Carnegie-Illinois Steel Corp., in 1935, he remained in that position until April 1939, when he was elected by United States Steel Corp.

Thomas H. Morcom, 57, general factory superintendent, General Railway Signal Co., died recently in Rochester.

T. H. MORCOM

He joined the company in 1912 and except for the period 1916-19 has served the company continuously.

William S. Taylor, for 26 years purchasing agent, Leland-Gifford Co., died January 18 in Worcester, Mass.

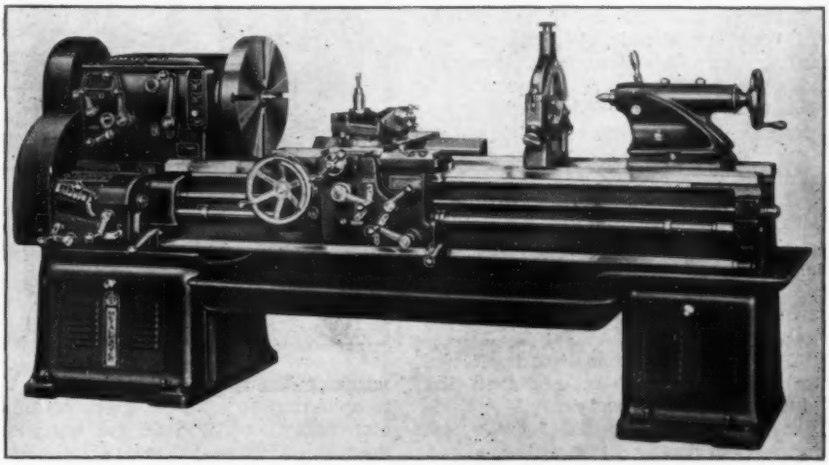
MEETINGS

American Foundrymen's Association. Annual convention. Cleveland, Ohio. April 20-24.

American Society for Testing Materials. Spring Meeting. Cleveland, Ohio, Mar. 4.

American Society of Tool Engineers. Annual meeting. St. Louis, Mo. March 26–28.

SHOP EQUIPMENT NEWS



Bradford "Metalmaster" Lathes Have 64 Changes For Threads and Feeds; Twelve Spindle Speeds

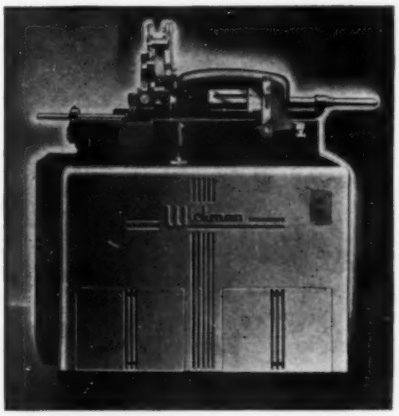
Metalmaster lathes of 12-, 14- and 16-in. capacities are available from the Bradford Machine Tool Co., 657-671 Evans St., Cincinnati, Ohio. Forward and reverse spindle speeds—twelve each way—range from 16 to 400 r.p.m. Sixty-four thread and feed changes are provided on each machine. With the 12- and 14-in. lathes, 1½ to 368 threads can be cut per in.; feed changes range from 0.00072 to 0.1780 in. per spindle revolution. One to 224 threads per in. are cut on the 16-in. lathe with feed changes of 0.0011 to 0.2670 in. per rev.

Available bed lengths are 6, 8, 10, 12 and 14 ft. for all machines, with an additional 16 ft. bed for the two larger models. Maximum taper per ft. with taper attachments is 4 in. At one setting taper attachment turns 16 in. Other attachments include: follow rest, draw-in collet, collet rack, micrometer positioning stop, thread chasing stop and lead screw reverse.

Specifications for the 12-in. lathe are swing over bed, 14½ in.; swing over carriage bridge, 9⅜ in.; weight, 3,000 lb. For the 14-in., they are respectively 16½ in., 11⅝ in. and 3,200 lb.; and for the 16-in., 18½ in., 14¼ in. and 4,000 lb.

Wickman Automatic Produces Precision Parts for Fuzes

The Wickman Corp., 15533 Woodrow Wilson Ave., Detroit, Mich., has introduced a Swiss type automatic machine which is being manufactured by the Sheffield Corp., Dayton, Ohio. The Wickman organization tools and services as well as markets the machines. The machine is particularly adaptable to the production of pinions, shafts and long, slender parts used in the manufacture of meters, instruments, radio and other precision work. In armament work it makes striker pins, detonators and fuze pinions.

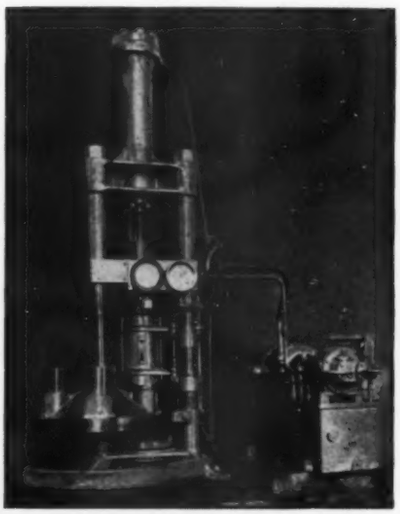


Five tools are mounted radially on the tool head. Only single point turning tools are used and all mountings are provided with micrometer adjustment in both directions. Sliding headstock feeds the work through the tools. With a combination headstock and tool movement, any angle or form may be produced without forming tools. There are almost no limitations to the scope of the back shoulder work which can be done. Many parts, even those incorporating a pivot point can be finished in cutoff, eliminating second operations.

60 Shell Tested Hydrostatically Per Hr. With Baldwin Press

Some classes of 75 mm. shell must be hydrostatically tested under pressure in excess of 20,000 lb. per sq. in. To fully meet this requirement, the Baldwin Southwark Div., the Baldwin Locomotive Works, Philadelphia, Pa. have constructed a turret type shell testing press. Completely self-contained, it will test approximately 60 shell per hr. The rotary turret carries fixtures for three shell. At one station shell body is filled with water, at the second it is tested, and at the third it is gaged.

Only shell in which an inspector finds evidence of cracks or porosity must be tested in this manner. The questionable shell is clamped in place with a double acting hydraulic piston located in the base of the machine. Upper



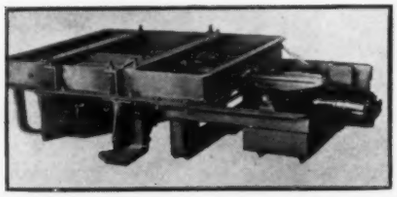
plunger is then moved into the water filled shell body. This plunger acts as an intensifier ram, raises the hydrostatic pressure within the shell to the point where cracks and porosity are shown by failure or leakage. A gage indicates pressure within the shell.

Cleveland Automatic Switch Speeds Materials Handling

An electrically operated track switch, known as motor-driven Type H, for use on cab-operated, gravity or automatic dispatch overhead materials handling systems, was developed by the Cleveland Tramrail Division, Cleveland Crane and Engineering Co., Wickliffe, Ohio. Operator can preset the switch at some distance ahead while traveling, thus saving time usually lost when

switching by hand. Likewise, indexes on gravity or automatic dispatch carriers may be set to actuate trippers which will cause one or several switches to take the desired position.

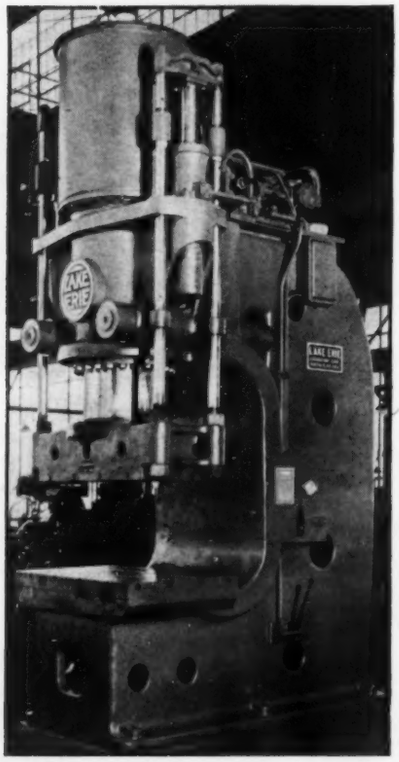
Switch, built of welded steel, consists of two main assemblies: an outer sup-



porting bar and an inner sliding frame. Outer frame bolts rigidly to the superstructure. The inner assembly carries a straight and a curved rail, rides on multiple easy-operating rollers and is set in position by a motor-driven cam through a lever arrangement.

Lake Erie Plate Bending Press Adapted for Shipyard Use

A 400-ton hydraulic plate bending press, especially adapted for ship-building use, has been announced by Lake Erie Engineering Corp., Buffalo, N. Y. Handling of work is facilitated by a gap type "C" frame. Press has 30-in. throat, 24-in. stroke and 36-in. daylight opening. Sensitive control of



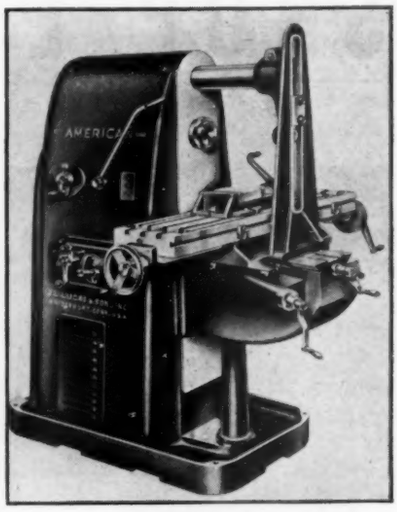
pressure for bending operations is provided by a conveniently located hand lever. Hydraulic pressure is maintained by a self-contained pumping unit mounted on top of the machine.

J. L. Lucas Redesigns No. 2 Plain Miller; Spindle Speeds Infinite From 25 to 500 R.P.M.

J. L. Lucas & Son, Inc., Bridgeport, Conn., have redesigned the No. 2 American Plain Miller to meet modern milling requirements. Spindle with standardized flanged spindle nose with No. 40 taper has an infinite number of speeds between 25 and 500 r.p.m. There is a 21/32 in. diameter hole through the spindle. Working surface on the table is arranged with generous oil pockets and three tee-slots. It has both power longitudinal and power transverse feeds, 16 in number, ranging from 0.005 to 0.212 in. per rev. of spindle.

The working surface of the table is 46x10½ in. Longitudinal power feed of 25 in. and transverse power feed of 9 in. are provided. Vertical hand feed up to 19 in. is possible. Maximum distance from center of spindle to table top is 19 in.

Drive from motor in base is effected through multiple V-belt and twin disk duplex machine tool clutch. Vari-Drive motor is supplied for 220, 440 or 550 volts, 25, 50 or 60 cycle, a.c. Infinite variations in speed are ob-



tained instantly while the machine is in operation by a single direct reading dial control. The machine occupies floor space 85x68 in. and weighs approximately 3,500 lb.

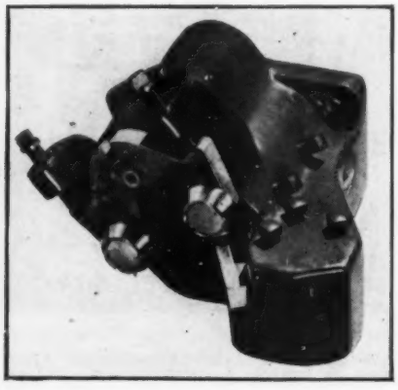
Gisholt Makes Pointing, End Facing and Forming Tools

Two turret lathe tools—one an end facing and forming tool, and the other a pointing tool—are announced by Gisholt Machine Co., 1201 E. Washington Ave., Madison, Wis. The end facing and forming tool is used for facing, forming and chamfering the ends of shafts, studs, bolts, screws and similar items. The second tool, similar in construction, provides a quick means of chamfering the ends of similar work pieces for true starting on a single or multiple cutter turner.

Rollers on each tool are mounted on needle bearings and are easily set for diameter. Substitution of a roller support assembly equipped with straight rather than bevel rollers converts the

End facing, forming tool works ends of bolts, shafts and studs.

pointing tool into an end facing and forming tool. Both tools may be used for light turning. Ample cutter room is provided in each case.



Pointing tool used for chamfering ends of work for true starting on single or multiple cutter turner.

Barrels Lifted, Moved, Rotated, And Tilted by Falstrom Lifter

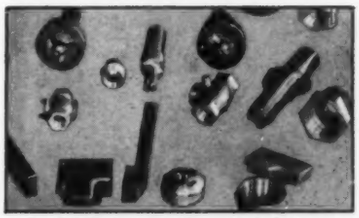
A barrel or drum handling unit which lifts, moves, rotates and tilts most types of barrels or drums has been manufactured by the Falstrom Co., Main Ave., Passaic, N. J. To lift a drum standing on its end on the floor, the lift is brought into position and the drum cinched in the lift saddle. By bringing down a U-shaped handle connected by links to the saddle, the barrel is raised from the floor. In this position the lift rolls on its wheels. Farthest downward movement of handle

For Rush Tooling Braze Your Own Carboloy Tools

When you need tools in a hurry—when a job demands immediate tooling—mill, braze and grind your own Carboloy tools! Three simple operations, done in your own tool room—and the tool is on the job. It's *fast*—less than an hour is required for most single-point, straight-shank tools.

It eliminates ordering time and "hold-ups" awaiting deliveries.

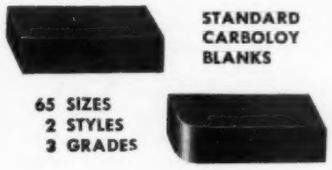
Keep a stock of Carboloy Standard blanks in your tool crib . . . ready at a moment's notice to make up tools. You simply recess a shank to accommodate the Carboloy blank—braze in the blank—and grind the brazed tool.



Typical Carboloy tools made by a brass goods manufacturer.

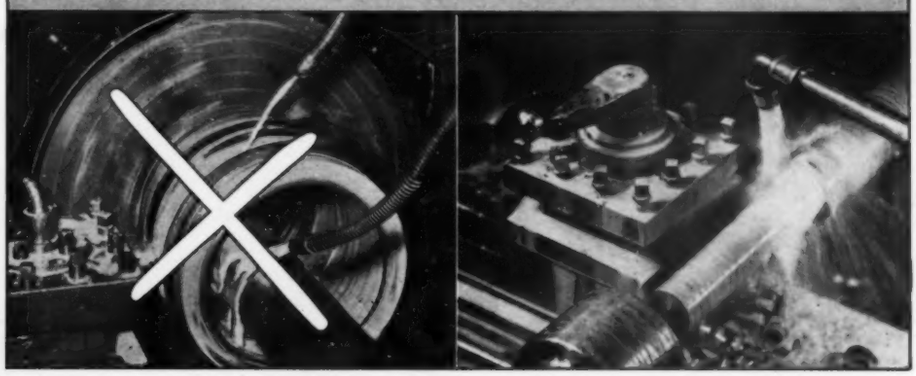
With these three simple steps you're prepared to meet emergency tooling immediately.

A new 32-page Carboloy Tool Manual, No. GT-133, shows you exactly how to do the job and also



contains data essential for subsequent use and maintenance. This manual, with Carboloy Standard Tool and Blank Catalog, No. GT-140, listing Carboloy Standard Blanks—65 sizes, 2 styles, 3 grades—sent upon request.

When You Use Coolant with Carbide Tools — Use *PLENTY* of It!! —



A weak stream of coolant is ineffective and results in reduced tool life.

An ample volume of coolant at high velocity carries away heat rapidly and continuously.

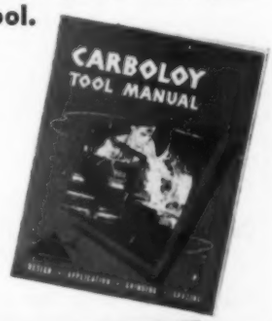
TO INSURE best results when you use coolants with cemented carbide tools, always provide an ample flow of sufficient volume and velocity to reach, and adequately cool, the cutting edge of the tool. A weak, thin stream may often do more harm than good since the high speeds used with carbide tools—usually above 200 feet per minute—may cause most of the coolant to be carried away from the work before it reaches the point of the tool.

If you want to provide best possible conditions for efficient use of coolants do these two things:

USE VITAL CEMENTED CARBIDES EFFECTIVELY!

1. **Make sure that coolant pump, tank, and supply pipes are of sufficient capacity to maintain large flow at high velocity *without appreciable rise in coolant temperature.***
2. **Make sure that coolant is actually reaching the cutting edge of the tool by providing adequate velocity and directing flow along an unobstructed path directly towards point of tool.**

For complete details and sketches, consult page 20 of Carboloy Tool Manual No. GT-133, available upon request, without obligation.



CARBOLOY COMPANY, INC.

11149 E. 8 MILE AVE., DETROIT, MICH.

Chicago • Cleveland • Los Angeles • Newark • Philadelphia Pittsburgh • Worcester, Mass.

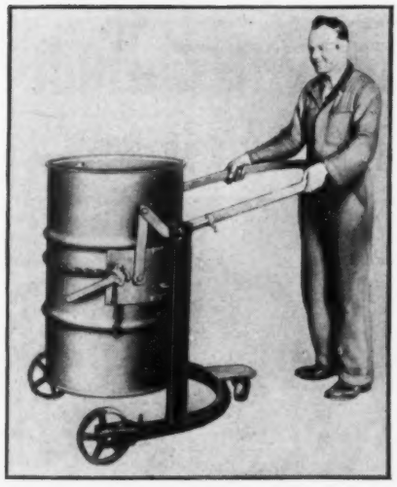
***Canadian Distributor:* Canadian General Electric Co., Ltd., Toronto, Canada**

CARBOLOY Reg. U.S. Pat. Off.

CEMENTED CARBIDES

TOOLS - DIES - DRESSERS
CORE BITS - MASONRY DRILLS
- WEAR RESISTANT PARTS -

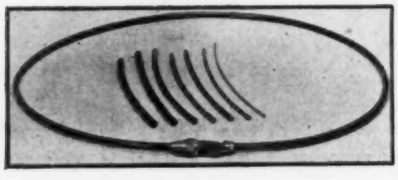
FOR THE MANUFACTURING · MINING · TRANSPORTATION · CONSTRUCTION INDUSTRIES



places the drum at its highest position where it can be rotated or tilted for pouring contents. One model is available especially for curved barrels. Barrels or drums of approximately 55 gal. capacity are accommodated.

Thermoplastic by Arcadia Replaces Metal in Tubing

A thermoplastic tubing, fabricated by Arcadia Synthetic Products Div., Western Felt Works, 4115 Ogden Ave., Chicago, Ill., will replace metal tubing in nearly all applications, except where extremely high temperatures and very high pressures are encountered. The tubing made of Saran, is fabricated in



a wide range of sizes and thicknesses ranging from ⅛ to ⅜ in. outside diameter. Standard floor type or compression fitting can be used as connectors. Under fatigue test, tubes were flexed 2,500,000 times through a 15 deg. arc, at 1,750 flexings per min. Not only is it remarkably tough, but it is highly resistant to moisture, brine, solvents, acids and alkalies. The plastic is also being fabricated in sheets with thickness from 1/32 to ½ in.

Combination Snips by Penn Tool Cut Right or Left Curves

Combination snips, developed by Penn Tool Co., 2415 N. Howard St., Philadelphia, Pa., cuts all grades of steel, BX cable, flexible tubing and Monel. Either right or left curves can be cut with this tool. Blades are removable and are serrated to prevent slipping and turning. Three sizes are available: No. 185 for light general work, No. 190 for cutting metal up to 16 gage and No. 195 for 18 gage.

Pipe to ⅜ In. Diameter Tapped With Machine Made by Pacific

A precision tapping machine for tapping pipe up to ⅜ in. is announced by Pacific Tool and Supply Co., 344 N. Vermont Ave., Los Angeles, Calif. Spindle is full floating, the tap is guided by changeable precision leads.

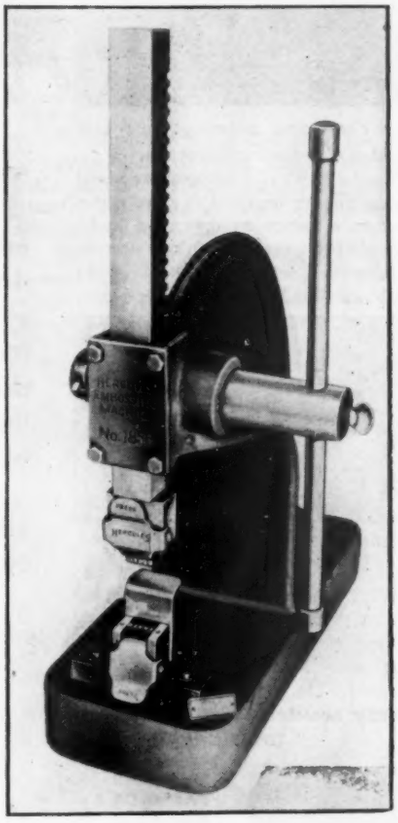
These leads can be furnished for any screw pitch, right or lefthand threads. Tapping handle can be set at any convenient position. When handle is released spindle is automatically thrown into neutral. Dial indicator facilitates bottom tapping.

American Foundry Develops Nozzle With Ceramic Insert

An abrasive blast nozzle using a hard, abrasion resisting ceramic instead of metal for the insert has been developed by American Foundry Equipment Co., Mishawaka, Ind. The ceramic insert has a hardness and density that is superior to many of the metals generally used for this purpose. Cost of compressed air is kept at a minimum because the nozzle wears slowly and evenly. Contour of a blast stream is maintained, and the work is cleaned faster and more uniformly as a result. Being non-metallic, the nozzle reduces static to a minimum. Both flange and screw-type adapters can be supplied to fit the nozzle for any type of air blasting equipment.

Acromark Press Embosses Plates, Parts, Tags, Checks

Metal name plates, parts, tags, badges and checks can be embossed with the arbor press outfits recently announced by the Acromark Corp., 251 No. Broad St., Elizabeth, N. J. Upper and lower Hercules holders are incorporated in this machine. Type is quickly interchanged. Characters match perfectly.



A mirror finish metal plate in back of one holder shows a reflected image of each character face which expedites matching the upper and lower characters.

Positive Seal for Transmission Of Air, Oil Provided by Kellogg

Positive seal at point of transmission of air or oil under pressure or vacuum from stationary to rotating member is provided by Rotorseal, produced by Kellogg Division, American Brakeshoe & Foundry Co., 97 Humboldt St., Rochester, N. Y. The device consists of a shaft rotating in a sealed double roll ball bearing. Sealing is achieved by a non-metallic nose bearing against the face of the rotating shaft. Rotorseal

There is *no shortage of Torrington Needle Bearings* for priority applications... they can be delivered with the promptness you need to maintain your production schedules!

When the Needle Bearing was introduced eight years ago, design engineers in every field quickly recognized its unusual merits. Encouraged by the steadily rising sales that confirmed industry's growing acceptance of the Needle Bearing, Torrington began a program of plant expansion designed to permit wider utilization of the bearings' potentialities. With the beginning of defense activities, indications of still heavier demands provided the basis for further expansion, and today production is geared to meet the needs of the Victory program.

The Needle Bearing has already demonstrated its efficiency in countless industrial applications, where its small size, low cost, high capacity, ease of installation and lubrication have made possible improvements in product design and operation, or reductions in manufacturing costs. And today there is a still more important reason for the use of the Needle Bearing—its availability for *prompt* shipment on rush orders.

You can eliminate one source of production delays by planning *now* to incorporate the Needle Bearing in your designs. Torrington engineers will be glad to work with you in adapting the Needle Bearing's advantages to your specific problem. For full details write for Catalog No. 105.

NO SHORTAGE HERE!

THE TORRINGTON COMPANY
TORRINGTON, CONN., U. S. A. • *Estab. 1866*
Makers of Needle and Ball Bearings
New York Boston Philadelphia Detroit
Cleveland Chicago Los Angeles Seattle
San Francisco Toronto London, England

TORRINGTON NEEDLE BEARING

EFFICIENT OPERATION

Torrington Needle Bearings permit anti-friction construction at important points in A.C.F. passenger coaches, giving smooth, efficient operation. Needle Bearings contribute also to reduction in need of service attention, because of their long life and efficient lubrication.

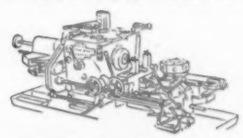
THE A. C. F. MOTORS COMPANY

SAVINGS IN WEIGHT

Needle Bearings themselves are light in weight, and their simple design often permits additional weight savings through simplification of surrounding parts. These advantages are especially important in aircraft applications—for example, in Republic's P-43 "Lancer" pursuit plane.

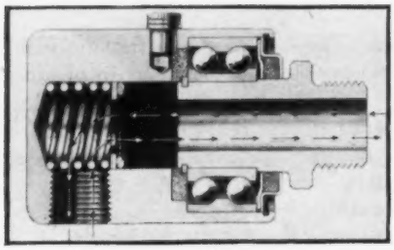
REPUBLIC AVIATION

LONGER SERVICE LIFE



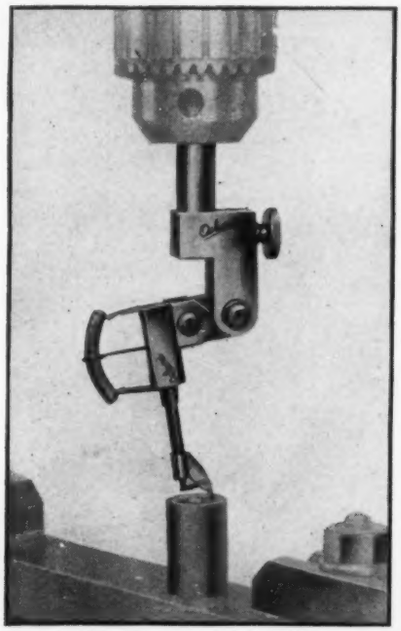
Use of Needle Bearings at six locations on the power automatic chuck unit of Warner & Swasey's No. 2 Turret Lathe results in longer life of the unit, insures smooth operation as well. High capacity and small size of the Needle Bearing are additional advantages in this application.

THE WARNER & SWASEY CO.



can be run continuously in either direction and can be reversed as often as necessary. It is suitable for pressures to 150 lb. and temperatures to 200 F. Five sizes from ¼ to 1½ in. are available.

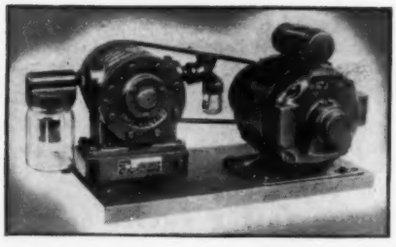
Oslund Holder Facilitates Use Of Universal Indicators



Oslund Tool & Die Co., Hartford, Conn., has introduced an adjustable holder for use with universal indicators. To set indicator, one screw in the holder is loosened and the indicator moves to approximate position. Final adjustment is regulated with the micro-adjusting screw.

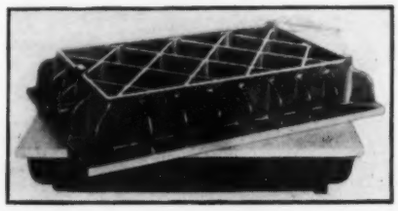
Gast Vacuum Pumps Made For Slow-speed Applications

Model 15F50 has been added to the line of vacuum pumps and compressors manufactured by the Gast Mfg. Corp., Hinkley St., Benton Harbor, Mich. This model is suited for slow-speed applications. Its capacity in cubic ft. per min. provides medium vacuum service. By changing size of the motor pulley, this pump is readily adapted for operation with ¼, ⅓, ½, and ¾ hp. motors.



Eight Surface Plates Included In Tool Engineering's Reid Line

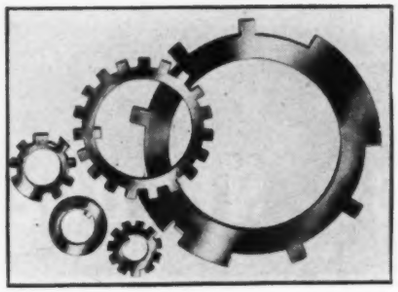
Eight different sized surface plates are included in the Reid line introduced by the Tool Engineering Service Co., Inc., 243 Washington Ave., Nutley, N. J. Plates are normalized and weather-



seasoned. Available with either scraped or planed finish, they have heavy webbed underframes and three-point support. Covers are provided for scraped plates. Smallest of the eight sizes is 12 in. wide, 18 in. long and 3 in. high, while the largest is 36 x 72 x 12¼ in. The larger plates have a tapped hole at each end to facilitate handling.

Dayton Rogers Stamps Washers In Custom Shapes From Alloys

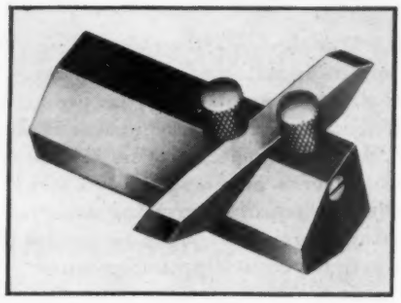
Custom made lock washers, including thrust washers in various sheet alloys, are manufactured by a special die stamping process developed by the Dayton Rogers Mfg. Co., Minneapolis,



Minn. In quantities of 100, special custom washers may be stamped to definite requirements at a comparative cost of 6 or 8 hand-made washers. Capacity ranges in size from ½ to 12 in. in diameter.

Acro Master Holder Positions Tools for Accurate Grinding

A master holder gage which positions thread cutting tools at the proper angle while being ground is announced by Acro Tool & Die Works, 2832 W. Montrose Ave., Chicago, Ill. Gage can be

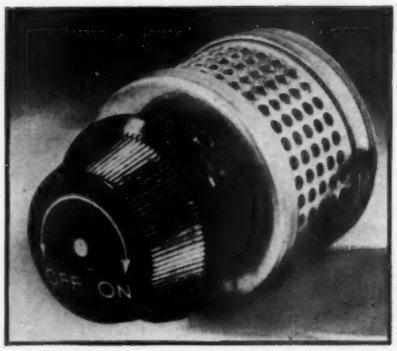


used with any type grinder. It consists of a one piece base, milled and slotted to position the tools.

Tool bit is held within the slot by set screws, one of which takes up any lateral motion that may occur. Skilled operators are not required to obtain accurate grinds. Moreover, grinding operations are limited to fixed angles, avoiding regrinding and saving tool steel.

Clarostat Rheostat Withstands Hard Use; Terminals Flat Lugs

The armored type power rheostat made by the Clarostat Mfg. Co., Inc., 285-7 N. 6th St., Brooklyn, N. Y. withstands hard usage, particularly where the unit

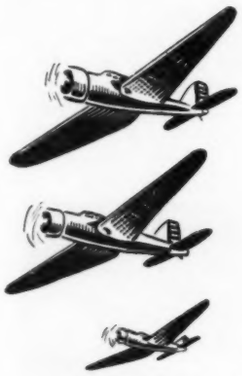


is exposed. These 25-watt rheostats are available in standard resistance values of 1 to 5,000 ohms. Flat lug terminals are brought out at the rear of the casing.

MSA Ear Defenders Lessen Fatigue, Increase Efficiency

Fatigue, irritability and nervous exhaustion experienced by workers in or about noisy operations are lessened by use of ear defenders, introduced by Mine Safety Appliances Co., Braddock, Thomas and Meade Sts., Pittsburgh,

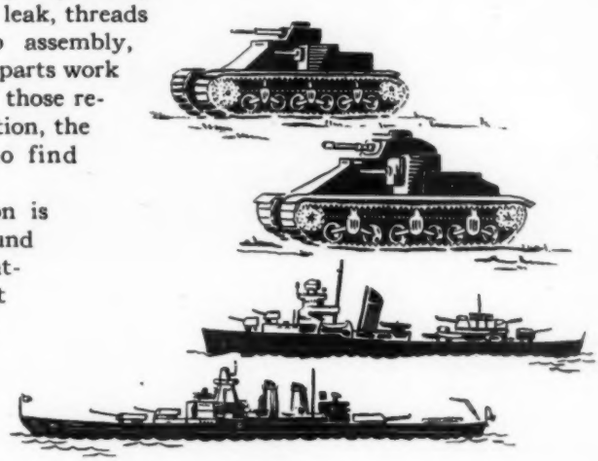
TAPS *for* JAPS



ON THE DAY when "Taps" is blown over Japan's and the Axis' military Imperialism, "Detroit" precision ground taps will once more be demobilized for non-defense use.

Today they are required to thread those all-important parts for airplanes, engines, ordnance, tanks, etc., in which accuracy spells the difference of fighting superiority. Threads that will not leak, threads that will not tie up assembly, threads that will not let parts work loose—wherever you find those requirements in War production, the chances are you will also find "Detroit" taps being used.

In "Detroit" taps, precision is ground right into the tap—ground from the solid into specially heat-treated blanks—a heat treatment proven to insure maximum productivity with minimum variation. Another reason why production capacity of "Detroit" taps has had to be quintupled in the past year alone.



DETROIT TAP & TOOL Company 8432 BUTLER DETROIT

Pa. Loud noises are reduced to about 1/10 former loudness, but are designed so that warning signals and conversations can easily be heard. Ear defenders can be cleaned with soap and water and are packed in plastic pocket container with spring hinge cover.

Porter-Cable G-4 Grinders Use Either Dry or Wet Belts

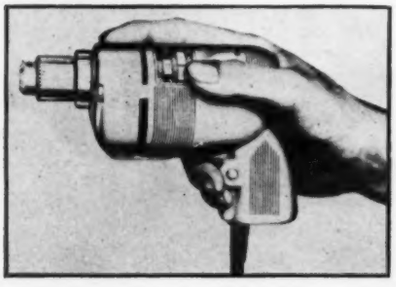
Either dry or wet belts can be used on the Type G-4 Belt Grinder added to the line of the Porter-Cable Machine Co., Syracuse, N. Y. It takes belts 4 in. wide by 45 in. in circumference. Wet belts on which either water or other coolant can be sprayed were recently

developed from resin-bonded abrasive.

Belt speed of 3,400 surface feet per min. is provided by the ¾ hp., 1,725 r.p.m. motor. A working surface of 40 sq. in. is provided by the flat backing plate 4 in. wide by 10 in. long. By removing three bolts, belts can be changed from vertical to horizontal position. Slotted rest table adjusts to a 45 deg. angle.

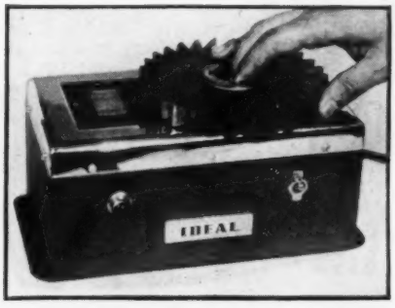
Skilsaw Light Drill Used On ¼ In. Steel; Weighs 2¾ Lb.

A drill with a capacity in steel of ¼ in. has been introduced by Skilsaw, Inc., 5033-43 Elston Ave., Chicago, Ill. The drill is small being only 6⅝ in. long, 2 9/16 in. wide and 2¾ lb. in weight. No-load speed is 1,800 r.p.m., and full load speed is 1,050 r.p.m. Two-pole momentary switch has lock for continuous operation.



Tools, Drills, Punches, Dies Demagnetized by Ideal Unit

Tools, drills, punches, dies and work held in magnetic chucks are quickly demagnetized with the portable unit introduced by the Ideal Commutator Dresser Co., 1057 Park Ave., Sycamore, Ill. Demagnetizing removes metallic dust, flakes and fine chips that cling



to the tool and which if not removed rub between tool and work, shorten tool life. Large parts may also be demagnetized by passing the demagnetizer over the surface of the part. The unit is 5¼ × 10½ × 4½ in.

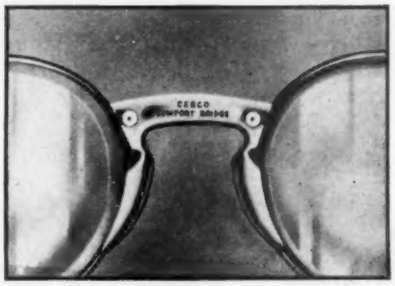
Clark Light-Weight Trucks Powered With Gas Engines

Due to weak floor construction, heavy material handling equipment cannot be used in some plants. To supply the need for a light weight power truck, the Clark Tructractor Division, Clark

Equipment Co., Battle Creek, Mich., designed the Clipper. These trucks are offered in six models with capacities of 1,000, 1,500 and 2,000 lb. and lifting heights from 60 to 108 in. The Clippers are powered by four-cylinder gasoline engines with self starters.

Chicago Eye Shield Goggles Have Comfortable Bridge

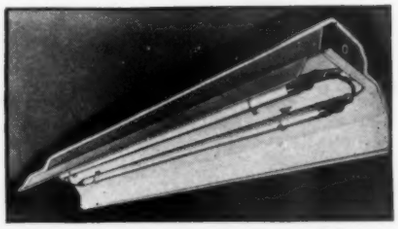
Spectacle-type goggles with a bridge designed for easier and more comfortable wearing, are manufactured by Chicago Eye Shield Co., 2310 Warren Blvd., Chicago, Ill. Designed as a single unit molded out of non-flammable plastic material the bridge has



wide bearing jumbo pads which distribute the weight evenly and float the frame without undue pressure across the bridge of wearer's nose. The bridge and pad are self-adjusting. Transparent side shields and leather-padded side shields are available with these goggles.

Benjamin Fluorescent Unit Minimizes Stroboscopic Effects

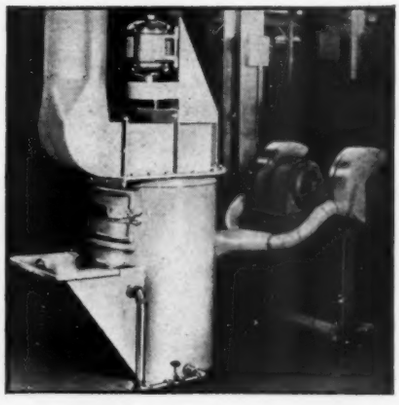
Type RF fluorescent lighting units requiring 85-watt lamps, are manufactured by Benjamin Electric Mfg. Co., Des Plaines, Ill. With these units 35 to 40 ft. candles of general illumination can be provided with a power consumption of approximately 200 watts when



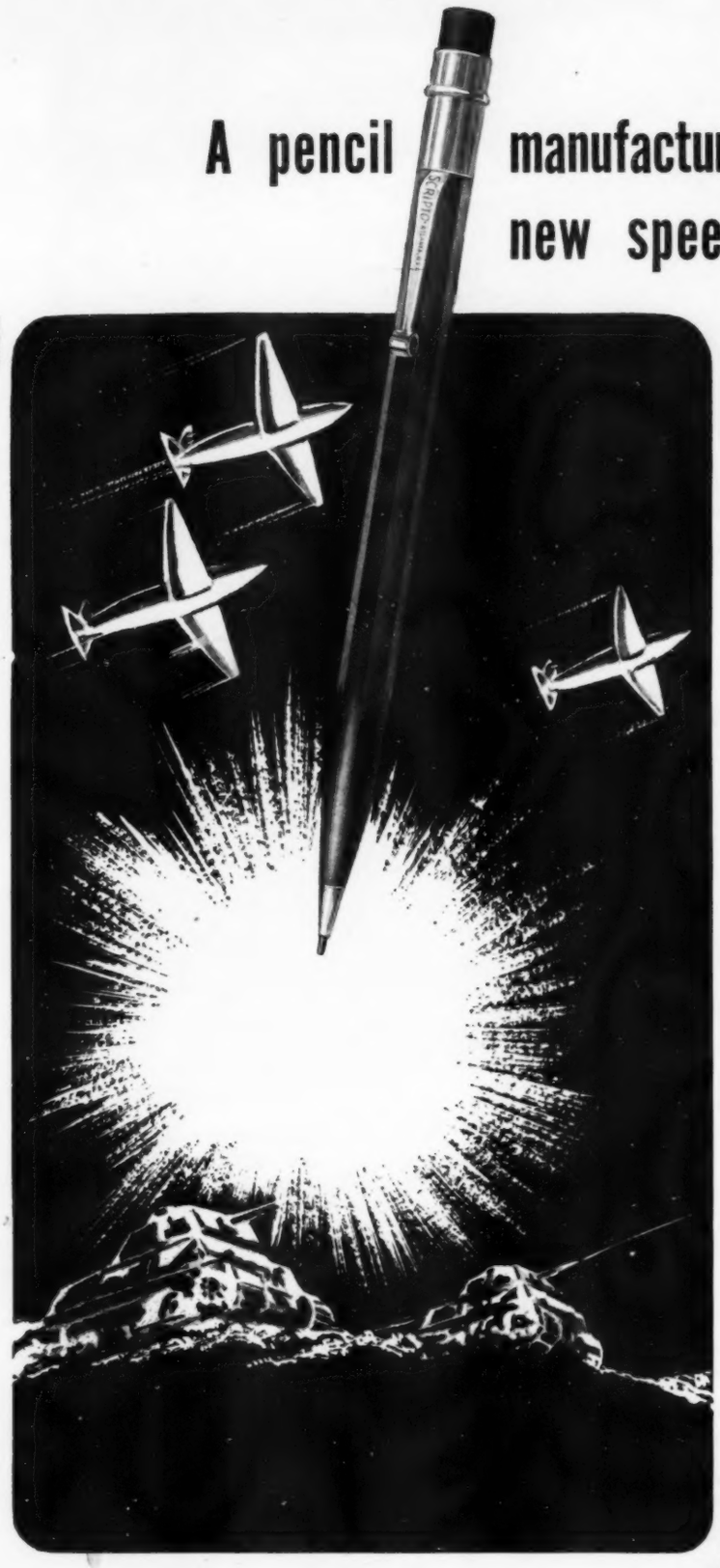
installed on a normal 10 x 10 ft. spacing. Full wave rectifier type circuit minimizes flicker and stroboscopic effects. Separate starters are not required. The units are 65¼ in. long.

Water Type Dust Collector By Newcomb-David Uses Spray

Newcomb-David Co., 5741 Russell St., Detroit, Mich., has introduced a water type dust collector for use with grinding and polishing machines. As the air



A pencil manufacturer showed the experts new speed in shell production



. . . *after Scripto and Revere worked together*

An output of 13 to 15 million automatic pencils a year is real production for any plant. This is the volume the Scripto Manufacturing Company has been producing.

But making brass boosters for high explosive shells is a very different problem. At least, that's what the experts thought when Scripto went to work for Uncle Sam. But production genius has a way of getting results . . . and today the Scripto plant is turning out millions of boosters at a high production rate.

If this were an isolated instance, or just luck, it couldn't mean much to you. But behind it is a story of skillful planning, in which a Revere Technical Advisor was able to supply the needed answers about brass. New tools were made, new machinery built, new gages designed, and new methods were worked out.

The first booster told the story. The set-up was right, and the brass from Revere was right . . . boosters started pouring out with almost the volume of the former "Scripto" pencils.

This is an example of the way Revere Technical Advisors have been able to help scores of Revere customers, old and new. If you are up against some problems in changing over, why not call Revere? It's the surest way to be *sure* in working with copper alloys and brass.

REVERE

COPPER AND BRASS INCORPORATED

Executive Offices: 230 Park Avenue, New York

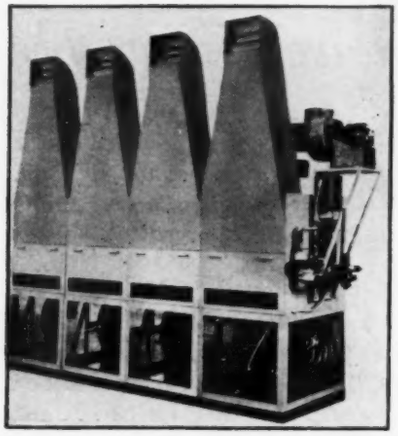
Sales Offices and Distributors in most of America's major cities

Mills: **BALTIMORE, MD. • NEW BEDFORD, MASS. • ROME, N. Y. • DETROIT, MICH. • CHICAGO, ILL.**

is drawn into the unit by a powerful exhaust fan it is drawn through a circular suction cone along with a spray from the water in tank below. Above the cone is a revolving screen moisture eliminator which separates the water from the air. Water soaked dirt and dust then falls into a sludge tank.

Janitrol Unit Heats Large Buildings: Factories, Hangars

Heating of large buildings such as airplane hangars and factories can be provided with the BBC-24 unit heater added to the Janitrol line of the Surface Combustion Corp., Toledo, Ohio.



Unit is built up of a series of sections, each having an input rating of 250,000 B.t.u. per hr. Each section is complete with its own heat exchanger, pilot, limit control and blower. Air is delivered at high velocities from 1,500 to 2,500 ft. per min.

Bargar Designs Fabricated Sheet Steel Machinery Guards

Fabricated sheet steel machinery guards, designed to supplant iron and aluminum castings, are being introduced by the Bargar Sheet Metal Co.,

Cleveland, Ohio. By welding and forming, the guards are streamlined and appear seamless from the outside. Holes are punched instead of drilled and an incurving flange provided. Sharp edges, thus, are eliminated.

Niagara Series 6 Shears Make 65 Strokes Per Min.

A Series 6 line of power squaring shears with capacities from 12 gage to $\frac{3}{16}$ in. and with cutting lengths from 4 to 12 ft. is introduced by the Niagara Machine & Tool Works, 637 Northland Ave., Buffalo, N. Y. Parallel back gage has settings to 1/128 in. Speed of 65 strokes per min. can be obtained. Driving elements are enclosed.

TRADE PUBLICATIONS

BRAZING Booklet B-3019 of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., tells how to cut production costs of metal parts with electric furnace brazing. Several plant installations of electric furnaces are shown.

CONTACTORS A 3-page booklet, No. 3283-A announced by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., describes multi-pole contactors for use on machine tools and controllers as relays in control circuits and to control small motors.

FLUORESCENT LIGHTING Fluorescent luminaires for lighting areas in industrial plants are described in a 2-page leaflet announced by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

FURNACES Installations of industrial furnaces for heat-treating are shown in a booklet put out by the Drever Co., 748 E. Venango St., Philadelphia, Pa.

GENERATORS A 4-page pamphlet describing latest motor generator sets for electroplating, anodizing and specialized industrial applications has been prepared by Motor Generator Corp., Box MG-1, Troy, Ohio.

HANDLING EQUIPMENT The American Pulley Co., Philadelphia, Pa. has published its catalog T-41 on hand trucks, wheels and other materials handling equipment.

MELTING FURNACES Two bulletins, Nos. 350 and 400, prepared by Fisher Furnace Co., 1740 N. Kolmar Ave., Chicago, Ill., describe stationary and tilting type crucible melting furnaces, either oil or gas fired.

PORTABLE CLEANERS Ideal Commutator Dresser Co., 1274 Park Ave., Sycamore, Ill. is circulating a 4-page brochure about portable cleaners for industrial use.

RAW MATERIALS Allis-Chalmers Mfg. Co., Milwaukee, Wis., has issued a 4-page booklet about the raw materials used by the company.

SAFETY EQUIPMENT A file catalog of safety equipment has been prepared by the Pulmosan Safety Equipment Corp., 176 Johnson St., Brooklyn, N. Y.

SAFETY FLOORING A 4-page folder about anti-slip stair treads, thresholds and floor tile has been prepared by the National Bronze & Aluminum Foundry Co., East 88th St. and Laisy Ave., Cleveland, Ohio.

SHAPER Features of a back-geared shaper are listed in a 4-page folder by Machinery Manufacturing Co., 1915 E. 51st., St., Vernon, Los Angeles, Cal.

SURFACE HARDENING A process for surface hardening stainless steel is outlined in a 4-page booklet prepared by the Drever Co., 748 E. Venango St., Philadelphia, Pa.

WELDING PROCEDURES In "Welding Procedures" Air Reduction, 60 E. 42nd St., New York, N. Y., recommends processes for welding particular metals. The best filler metals for each process are listed and specialized welding techniques not commonly known are described. Data is given for the calculation of electrode and gas welding rod

Keep 'em Cutting...Longer...Faster

SUNOCO EMULSIFYING CUTTING OIL PERMITS HIGHER P-Q* FOR PRESENT MACHINES

This is no time to worry over priorities on machine tools. Your urgent job is to set and maintain a higher P-Q* (Production Quota) with present equipment . . . and SUNOCO EMULSIFYING CUTTING OIL will help you do it!

SUNOCO has long been the choice of the leaders in the metal working industry. They know SUNOCO's high lubricating and heat absorbing qualities permit more pieces per tool grind . . . enable machine tools to operate at rated capacity plus . . . make possible finer finishes, closer tolerances, fewer rejects.

Let SUNOCO help you set a higher Production Quota. Call in a SUN "Doctor of Industry" — a metal working expert. Let him prove the merits of SUNOCO for stepping up production in your own shop . . . under your own operating conditions. Write today to SUN OIL COMPANY, Philadelphia, Pa.

*Production Quota

LET'S GO! U.S.A. KEEP 'EM FLYING!

PERFORMANCE DATA

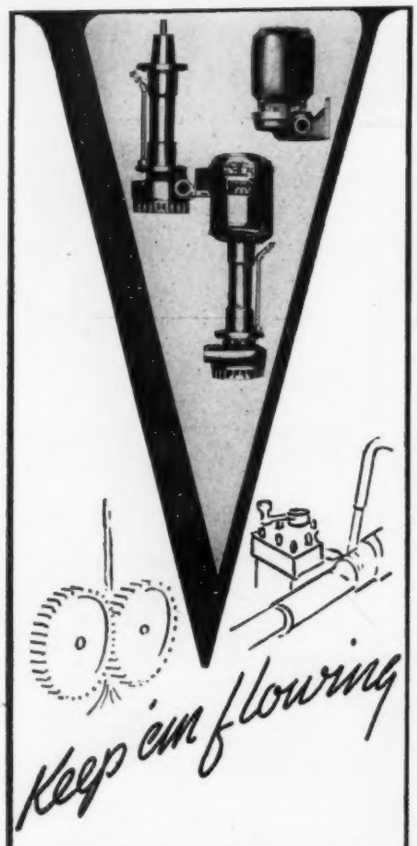
OPERATION — Turning 3½" bar

MACHINE — Warner & Swasey 2-A Universal Heavy Duty Turret Lathe

CUTTING LUBRICANT — 1 part Sunoco to 20 parts water

SUNOCO

SUN PETROLEUM PRODUCTS HELPING INDUSTRY HELP AMERICA



lubricant and coolant pumps MUST NOT fail!

Production must go on. The speeding gears that operate unnoticed under cover—the whirling drills that push into tough metals—the valuable cutters that bite off vast quantities of steel—all must have lubricant or coolant—constantly and in the right amounts—right from the very instant the wheels start moving—it must "be there" when needed.

Pioneer Pumps are dependable

The increased facilities provided through our new home assure you of quick deliveries. Send for a complete catalog showing sizes and models.

PIONEER ENGINEERING AND MANUFACTURING CO.
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consumption for different types of welds. The 56-page book is available to those making the request on company letterhead.

WORKER PROTECTION A safety products catalog in filing folder form has been issued by the Kimball Safety Products Co., 7314 Wade Park Ave., Cleveland, Ohio. Sections cover eye, body and hand protection, with a special report on safety equipment for welders.

NEW BOOKS

PRACTICAL ARC WELDING—*By W. J. Chaffee. 516 pages. Published by Hobart Trade School, Inc., Troy, Ohio.* $2.

The accelerated use of welding, because of its application to many war products, has led to a demand for personnel trained in this process. This practical handbook on arc welding was written for men new in the field, and for experienced welders wishing to keep abreast of modern procedure.

Part I is devoted to general welding information. It tells where arc welding is used in manufacturing applications, available metals and alloys, type of joints, and electrodes, strength of arc welded joints, cost of arc welding, and many other pertinent data.

Parts II and III are devoted to a complete series of arc welding lessons, as they are offered in the Hobart Trade School. They cover welding technique, from preliminary instruction to the more advanced problems.

Parts IV and V include a dictionary of welding terms and 20 pages of tables for operators and designers. The Handbook is conveniently bound in a flexible fabricoid cover, and is well indexed.

•

AMERICAN INDUSTRY IN THE WAR—*By Bernard M. Baruch, chairman of the War Industries Board of World War I. 498 pages.* Published by Prentice-Hall, *Inc., 70 Fifth Ave., New York.* $5.00.

No one in America knows more about the effective operation of industry in wartime than Bernard Baruch, who had dictatorial powers over industrial production under Woodrow Wilson in the First World War. As General Hugh Johnson has said, "Mr. Baruch has had a more intense experience with the principles of industrial mobilization than any other living man." He maintained his interest in that subject through the twenties and thirties, and since the start of the defense program has been a constant and frequent visitor at the White House.

Now that America is actually at war, and her role is, among other things, to be the arsenal for "the united nations" which oppose the Axis powers, Mr. Baruch's ideas on how to achieve the most efficient industrial organization in wartime are of paramount importance. They are set forth in the book "American Industry in the War." In this single volume is set forth Mr. Baruch's report of the War Industries Board of the First World War, showing the strength and weaknesses of the 1917-1918 operations. The book also contains Mr. Baruch's own program for total mobilization of the nation as presented to the War Policies Commission in 1931. Copies of many of the Priorities Circulars issued by the War Industries Board, of Preference Lists, of Fixed-Price Schedules and of other special reports issued in the First World War are included.

It may be true that the pattern of the present war does not follow that of the 1917–1918 conflict and that we cannot rely too much on what happened then to guide us now. However, a perusal of Mr. Baruch's documents is most enlightening and leads one to the conclusion that much of the current grief might have been avoided if our experience in the First World War had been taken into consideration. As Mr. Baruch points out in the preface to this volume, "The War Industries Board plan contemplated getting ahead and keeping ahead—avoiding bottlenecks which are proving in 1940 and 1941 what they proved in 1917 and 1918. It is regrettable that we have to retravel any of that road. . . . At times the reader will have to raise his eyes from these pages to wonder whether he is reading what took place a quarter of a century ago or what is unfolding before us daily."

For those who wish guidance in how to deal most effectively with industrial mobilization at this moment, Mr. Baruch's book is *must* reading.

Materials Saved by Redesign, Substitution and Simplification

At the East Springfield plant of the Westinghouse Electric & Manufacturing Company, where refrigerators and motored domestic appliances are made, a vitreous enameled steel evaporator has been substituted for the brass evaporator made for refrigerators. Difficulties in the shop caused by cracking the enamel have been eliminated by providing extra reinforcement and using somewhat heavier sheets.

Before shortages of essential materials occurred, some parts were redesigned to make use of copper brazing. Instead of a fan-cooled radiator, which was satisfactory in its performance in an earlier model, the design was changed a couple of years ago to a radiator which consisted simply of a long steel tube copper brazed to a pan which fitted in the back of the refrigerator and got its cooling by convection. In addition to this, certain other parts, such as the muffler and the strainer, which had previously been made from brass with silver-soldered connections, have been converted to steel stampings, copper-brazed together. Not only does this practice save vital material but

perhaps more important still, it saves many man hours.

At the Mansfield plant, where ranges, cooking devices and refrigerator cabinets are made, substitutions have been made which are of interest. Those cabinets which now are being made are equipped with hardware of either cast brass instead of aluminum die castings, or in the case of those parts which have no function other than to occupy space and give a pleasing appearance, lead antimony alloys are being employed. Thermoplastics are being used in some places instead of anodized aluminum, and while these are not too easy to get, the difficulty is not as serious as in the case of the phenolics.

Heater tubes for corox heating units have been made from a special stainless steel containing silicon. When this became a critical material, studies were undertaken to provide a different material which would not come under this classification. After some searching, it was found that one of the high chrome steels could be used, but this involved a great deal of development work at the factory to learn the proper schedule for swaging. These difficulties have now been overcome. Possibly shortage of this material may force the adoption of a plain steel tube, cast in iron, or an open wire ceramic heater.

On one of the thermostats which operates at a relatively high temperature, it was necessary to make one of the current carrying parts from something which would not oxidize at high temperature and would have a reasonable conductivity. Stainless steel has been used for this with perfect success, but as the supplies of this material went lower and lower, it finally became impossible to obtain even the small amount needed for this piece. Silver now is being used with success without an unduly high increase in cost.

At the Lighting Division plant in Cleveland, it has been necessary to abandon the use of the Alzac-treated aluminum reflectors for non-defense work. This process is still being employed on defense jobs where it produces results which cannot be obtained in any other way. Certain of the commercial lines have been changed over to spun steel with a vitreous enamel. Silvered glass reflectors will be used in some places and these, while they have the disadvantage of high cost and fragility, do give very good reflecting properties.

At the Lamp Works in Bloomfield, experiments are being carried out to utilize a drawn steel shell for the screw base of lamps. This shell will be plated with brass. These bases already are in production on certain lines and will probably be completely adopted as soon as a few more wrinkles have been ironed out. The nickel support wires will be replaced by nickel-plated steel in some cases, and in others where the mechanical shock is not so severe, copper probably will be used.

The outstanding economy from the standpoint of quantity of critical material at the Meter Works in Newark is

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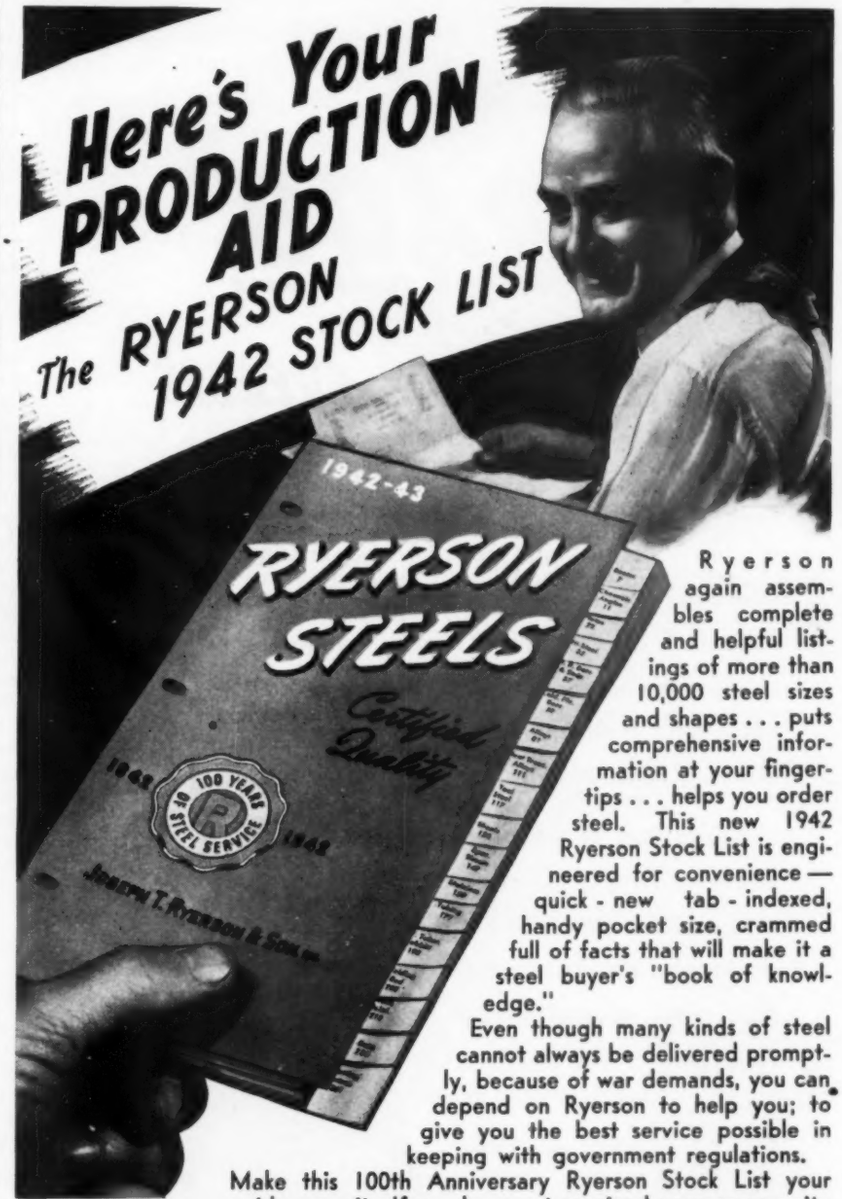
Warehouse Stocks of Steel Proving Big Help in Keeping Manufacturers Operating

A recent survey of industries indicates that most manufacturers are relying on nearby steel-service plants, more than ever before, to fill their requirements for small lots of steel. The leading company in this steel stock service is Joseph T. Ryerson & Son, Inc., who operate a vital network of 10 plants strategically located in busy industrial centers across the country.

The close cooperation between Ryerson's 10 plants offers two unique advantages.

First—Jobs at distant points; or the steel requirements of branch plants can be more quickly handled through local Ryerson offices. A local Ryerson office will take immediate action to assure prompt shipment.

Second—The local Ryerson office handles that *all important* "follow through" which assures prompt, accurate deliveries. Bring your steel needs or problems to Ryerson for prompt, intelligent cooperation. Phone your nearest Ryerson Steel-Service office. (See advertisement below.)



Ryerson again assembles complete and helpful listings of more than 10,000 steel sizes and shapes . . . puts comprehensive information at your fingertips . . . helps you order steel. This new 1942 Ryerson Stock List is engineered for convenience — quick - new tab - indexed, handy pocket size, crammed full of facts that will make it a steel buyer's "book of knowledge."

Even though many kinds of steel cannot always be delivered promptly, because of war demands, you can depend on Ryerson to help you; to give you the best service possible in keeping with government regulations.

Make this 100th Anniversary Ryerson Stock List your guide—use it. If you have not received your copy, write your nearest Ryerson plant. Joseph T. Ryerson & Son, Inc., Chicago, Milwaukee, St. Louis, Cincinnati, Detroit, Cleveland, Buffalo, Philadelphia, Boston, Jersey City.

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in connection with sockets for the outdoor watthour meter. These were originally aluminum die castings. Now, a drawn steel shell is zinc plated, bonderized by an improved method, and then given an organic finish. This will give reasonably satisfactory service, although it will not be as good over a long period of time as the aluminum-base die casting.

At the East Pittsburgh Works, nearly all chrome nickel steel has been or is being replaced by chrome molybdenum. Tungsten high-speed steel is partially replaced by carbon molybdenum steel which, while not as good as the tungsten steel, still gives fairly satisfactory service in simple single-edge tools. It is not adaptable to blanking dies so, for these a high chromium carbon steel is being used. This marks rather badly, so it is necessary to make dies for stator and rotor punchings out of many small pieces, hardened, assembled and then ground to final shape and size. This greatly increased the cost, but provides a die that does the work.

There is no doubt that while the substitutions and redesigns which have been employed will increase costs, and while those which deal with finishes will give a somewhat less acceptable result, the over-all performance of the equipment will still be satisfactory. There is the probability, also, that some of these changes will probably represent improvements which will continue after the present emergency has passed.

From an address by David R. Kellogg, assistant to manager, engineering standards department, Westinghouse Electric & Mfg. Company, before the American Society of Mechanical Engineers.

Substitutes for Tin

Problems of supply have made it necessary to study carefully the part played by tin in American industry, with a view toward substituting more available metals wherever possible. An interesting review of this subject is contained in the October, 1941, number of "Tin and Its Uses" published by the Tin Research Institute.

Because the whole of the supply of tin has to be brought from overseas, tin may be one of the first metals for which a shortage might develop. It has been stated that there is now from 12 to 15 months supply of tin in hand within the United States, compared with less than one month's needs of copper and a week's supply of zinc.

Taking average figures for 1936, 1937 and 1938, consumption of primary and secondary tin in the United States is estimated as follows: tinplate and terneplate, 43 percent; solder, 22 percent, bearings, 7½ percent; collapsible tubes and foil, 8 percent; bronze, 7 percent; other uses, 12½ percent. The largest individual use is the manufacture of tinplate, of which about

three-quarters goes into food packing. It is in this industry that the major reduction in tin consumption must be sought.

Glass and earthenware are plentiful and cheap, but the weight and cost of freighting both the empty and the filled containers is against them; because of their poor thermal conductivity both heating for sterilization and cooling afterward is slowed down and output hampered. Further, glass is easily broken, either by rapid changes of temperature or by rough handling, so that wastage, both of containers and their products must be faced.

Lacquered black-plate has been tried and has been reported on as satisfactory only for alkaline reacting foodstuffs; its use presents many problems as the present canning industry is built around the tin-coated steel container. Not only does the tin coating give protection, but it facilitates the sealing by solder of the body seam. Even when lacquer is applied over tin some porosity persists, and to dispense with the tin a new technique for applying and drying the lacquer would have to be developed, which would certainly be slower than the present practice.

Action has already been taken to reduce the thickness of the tin by about ten percent on tin plate for certain purposes. This reduction from 1.5 lb. to an average of 1.35 lb. per base box is within the range with which can makers are already familiar, and is in fact little more than following by administrative action what is already established in commercial practice. With improved qualities of cold-reduced steel and improving technique in applying the tin coat, the average thickness of the tin coat can be reduced without lowering the minimum thickness which now, as in the past, is the limiting factor. Changes of this nature are likely to be permanent, and to the ultimate advantage of all concerned, as every reduction in cost, without loss of performance-value will enhance the competitive merits of the tinplate package. The chief drawback to the present reduction in tin thickness is perhaps that it slows up tin pot production speeds.

Electro-deposition offers a method of applying a tin coating that is of uniform and controlled thickness, and for a number of purposes this type of tinplate is already being actively developed. Coatings as low as 0.5 lb. per base box are in use. But there is some likelihood of trouble in the side-seam soldering operation, and protection against atmospheric corrosion of the exterior is less than is desirable.

Alternatively, coatings of other metals have been proposed, silver and nickel being the more promising. Silver is, however, about twelve times as expensive as tin. Interesting containers have been made using a thin nickel coating alone, or combined with a reduced amount of tin, but for the present, scarcity rules nickel out as a possible substitute. It would seem that unless a considerable reduction in the

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Webster-Brinkley Co., Seattle, Wash., Makers of Steering Engines for ships, filed 13,200 port openings in cast iron cylinder valves with DoAll Band Files in 1/5 former time.

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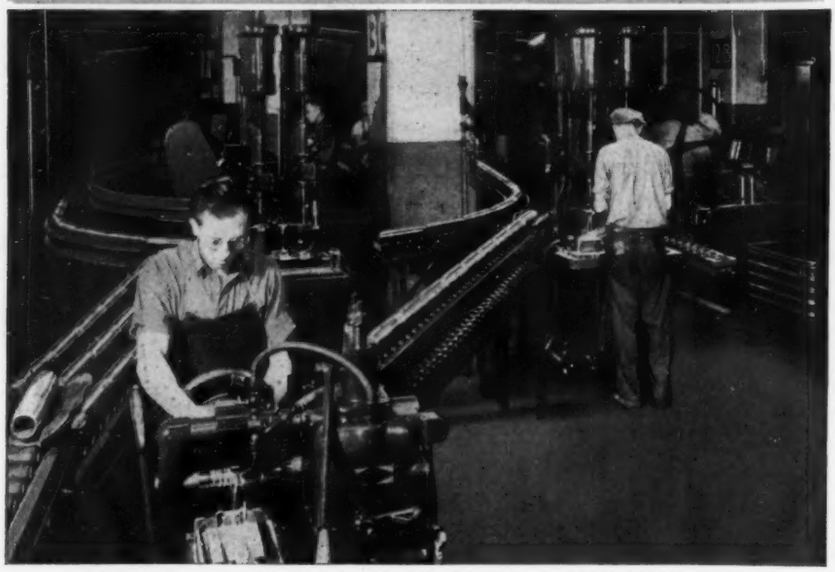
. . . VITAL "SUPPLY LINES" TO PRODUCTION MACHINES



CONVEYORS—planned and built by Standard—are a basic part of well organized production. They are the "arterial highways" of plant transportation—handling incoming material—work in process—keeping high-speed production machines well supplied—moving materials, parts, finished products from department to department. By cutting short handling time, eliminating repeated handling, avoiding wasteful waiting, they help to make manpower and man-hours count effectively in increased production.

Conveyorize To Meet Today's Need For Speed:

Your production and handling operations can be "conveyorized" with substantial savings of space, time and costs. Send for booklet (AM-2) "Conveyors by Standard"—a useful reference book on conveying and conveyors, contains many examples of conveyor installations, shows types of conveyors best suited to various units, parts, materials, products and commodities.

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GENERAL OFFICES: NORTH ST. PAUL, MINN.

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output of canned foods can be accepted, there can be no major switch from hot-tinned tinplate packaging.

Over a fifth of all tin used goes into solder. The most obvious expedient is to use alloys lower in tin and higher in lead; but this is seldom feasible, economic considerations having already left to the use of the lowest practical tin content. The thickness of the solder film required tends to increase, with a decrease in tin, and the use of a poorer solder may lead to an actual increase in the weight of tin consumed. Since the strength of a solder joint is greater when it is thin, the quality of the joint suffers by too low a tin content.

Nevertheless, substitute solder are available. Part of the tin may be replaced by cadmium, and cadmium-zinc alloys are in use. However, because of the normal scarcity of cadmium, and the temporary scarcity of zinc, neither promises to meet the present emergency. The large stocks of silver now in the United States gives a special feasibility to solders containing from 6 to 2½ percent of silver, and 94 to 97½ percent of lead. These solders are already employed for special purposes, and their use could be extended if allowance were made for their limitations. For instance, in radiator manufacture dip-soldering with tin-lead solders is done at 700 F.; the silver-lead solder would require a temperature of 850 F. This would tend to soften the cold-worked copper at present in use, and special alloys would have to be selected.

There are many alternative types of joint, such as lead burning, welding, and hard soldering, but the broad fact emerges that there are many jobs for which common solder is preeminently suitable, and that at present there is no substitute available with the low melting point and good wetting qualities of the lead solders high in tin, and that the next best alloys are more costly.

A wide variety of alloys are in use as bearings. The ordinary tin-base babbitt containing 85 to 90 percent of tin, the balance antimony and copper, represents the tin-rich end of the series and has been in wide use since its invention over a hundred years ago. With the increased strength of modern steels, the design of machinery has become more and more compact, and bearing pressures have increased. This has frequently called for materials of greater mechanical strength than babbitt as originally used, and the present position is exceedingly fluid. Progress has been made by reducing the thickness of the babbitt layer, and the increased backing and greater strength thus obtained have met many demands. Cadmium, alkali-hardened lead and copper-lead, sometimes with a little tin or silver, are used. All these alloys, however, are more prone to corrosion by active oil at high-bearing temperatures and call for shafts with specially hardened surfaces if scoring is to be avoided.

When U. S. Production Fights Its Battle at Sea

. . . FIBREEN protects the materials of war . . . *on deck and below* . . . against the hazards of transportation

FIBREEN is 6 ply: TWO layers of strong kraft, reenforced with TWO layers of crossed sisal fibers embedded in TWO layers of special asphalt—all combined under heat and pressure. FIBREEN is pliable and clean—will not scuff—stands an astonishing amount of abuse and exposure. Used either as a wrapping or lining material.

Soak it—twist it—try to tear it.

Only when you get a sample in your own hands can you realize that a *paper* can be so strong—so tough—and impervious to moisture. There is no other material like FIBREEN. In rolls and blankets of many widths.

A product of The Sisalkraft Co.—manufacturers of Sisalkraft, Sisal-X, Sisal-Tape and Copper-Armored Sisalkraft.

Long before shipments of war materials reach the front, they face the destructive onslaught of rain, waves, flying salt spray—possibly a dry, scorching sun—or snow and piercing cold. Protection against these hazards of transit is as necessary as armed protection against enemy submarines or bombers.

This protection must be made at the factory *in the shipping room*—and FIBREEN is recognized as one of the most effective, practical materials that can be used for protective packing. It is used as a liner for cases or as a tough, weatherproof wrapping. FIBREEN meets the most severe specifications and inspections. It's pliable, clean, inexpensive, is absolutely waterproof—amazingly strong, tough and durable.

Because of these qualities—and because of the vital importance of properly protecting the vast stores of war materials that pour from American production lines—finished goods, materials and supplies; as well as machines, tools or parts shipped from one plant to another—FIBREEN is now being allotted entirely to uses essential to the nation's war program.

Inquiry is invited from those industries that are in the "essential" classifications. Write, stating what you ship and how you now pack it.

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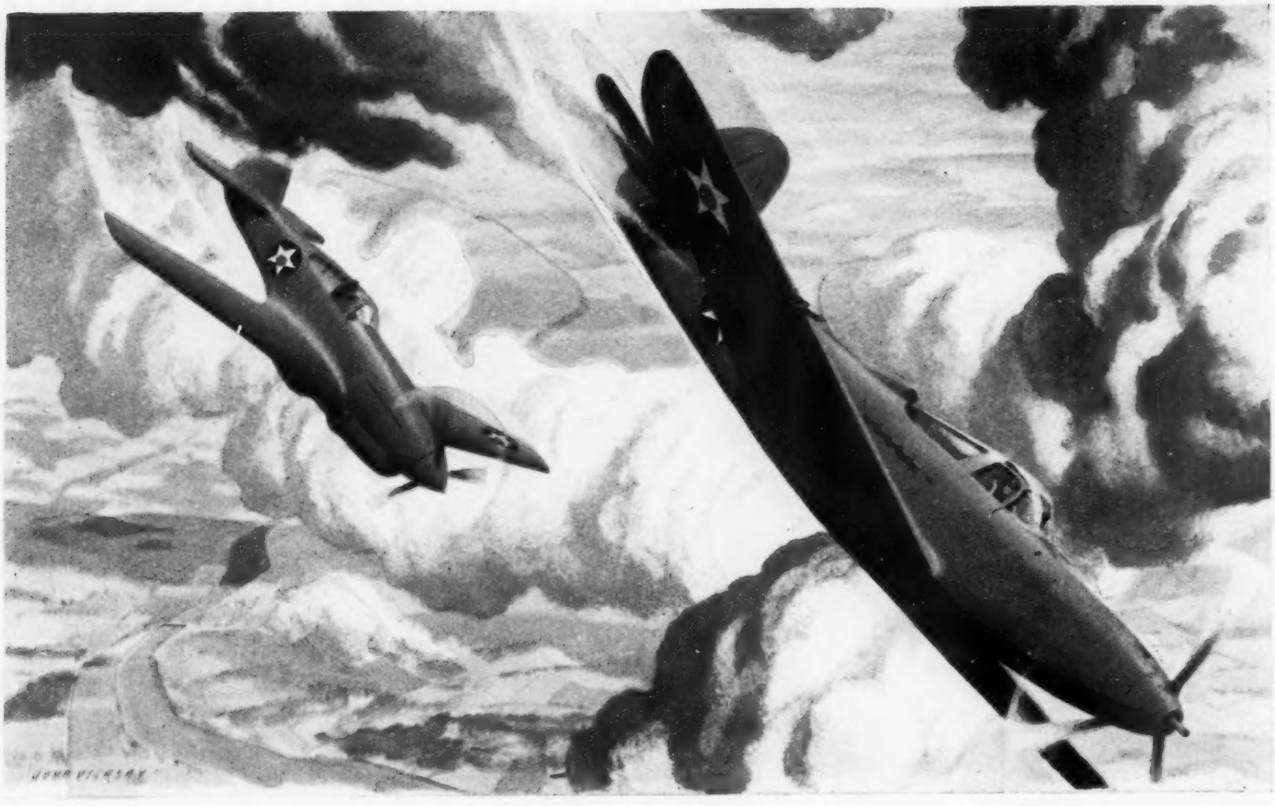

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REPORTS TO THE AMERICAN PEOPLE

IN THIS great national emergency we believe it is reassuring to read reports of progress made in the common task that confronts us all.

We have a report we wish to make to our fellow workers engaged in defense activities—a report on what we have done—are doing—and will do to meet the nation's mounting needs for magnesium.

Magnesium is the lightest of all structural metals—a full third lighter than aluminum. Its critical value is in contributing to American air supremacy—in saving those vital pounds that spell superior fighting speed—longer cruising range—greater load capacity.

Magnesium, therefore, is of deep interest to every American who holds dear the national heritages of our past—the hopes of our future.

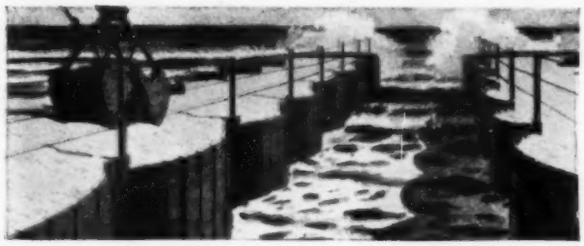
WHERE AMERICA STOOD IN 1939

The Dow Chemical Company began production of American made magnesium metal in 1915. It developed its own producing process, releasing this country from any dependence upon foreign sources of magnesium supply.

But, the manufacture of metal was only the first step. It required years of research and experience to develop a range of practical magnesium alloys (Dowmetal) to serve in various applications. Methods of fabrication had to be adapted to conform to the specialized characteristics of magnesium. And, equally important, American industry had to be familiarized with this ultra-light metal—to learn by test and experience how it could serve many needs. All these steps took time.

Despite all these factors, Dow, as the sole producer of magnesium for American industry, had developed by 1939 a domestic market requiring an annual production of 6,000,000 pounds—a notable accomplishment.

THE MAGNESIUM SITUATION IN 1940



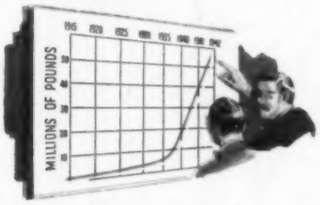
Early in 1940, Dow, having already sensed the rising need for magnesium in the awakening defense program, had voluntarily doubled the production facilities of its Midland plant.

Fast on the heels of this first step in a vast expansion program came even greater—more startling news. In March, 1940, Dow announced to American industry one of the most significant advances in modern chemical engineering—the first extraction of magnesium metal from the sea. This was the logical result of a long experience in the chemistry of natural brines.

Acquiring a 1000 acre site on the Gulf of Mexico at Freeport, Texas, work on a mammoth magnesium plant was started without an instant's delay.

Working at incredible speed—using at times a construction crew numbering 4,800 men—the first unit of this plant was completed and began production in the record-breaking time of ten months.

THE MAGNESIUM PICTURE IN 1941



On January 21, 1941, the first magnesium was poured —and shipped—from Dow's Texas plant. This was the first time in history that magnesium metal had been extracted in commercial quantities from sea water—a goal long sought but never before realized.

Combined with the already doubled production of magnesium at Midland, this made available an annual production rate of 36,000,000 pounds—a six-fold increase in our national magnesium supply in slightly over a year!

As the year 1941 progressed so did the production facilities for magnesium. By the end of the year, American aircraft and other defense producers measured Dow's magnesium production at over 50,000,000 pounds annually—a considerably greater tonnage every 45 days than was formerly required by American industry in an entire year.

A LOOK AT TODAY—AND TOMORROW

Today, magnesium is rolling out of Dow's Michigan and Texas plants in unprecedented volume and production is constantly mounting. In addition Dow is now building at great speed new plants for the government that will overshadow in size and capacity any now in existence in this country.

During those years when only the more progressive of American industrial engineers were utilizing the light-weight characteristics of Dowmetal, it would have seemed fantastic to think that some day the demand for this metal would soar to such stupendous heights.

Yet that day is here and Dow is meeting the challenge as a great opportunity to do a national duty. And, if tomorrow more is asked—Dow wants you, and every American, to know it will respond with every ounce of effort—every resource —at its command.

TRADE DOWMETAL MARK

DOWMETAL MAGNESIUM

TRADE DOW MARK

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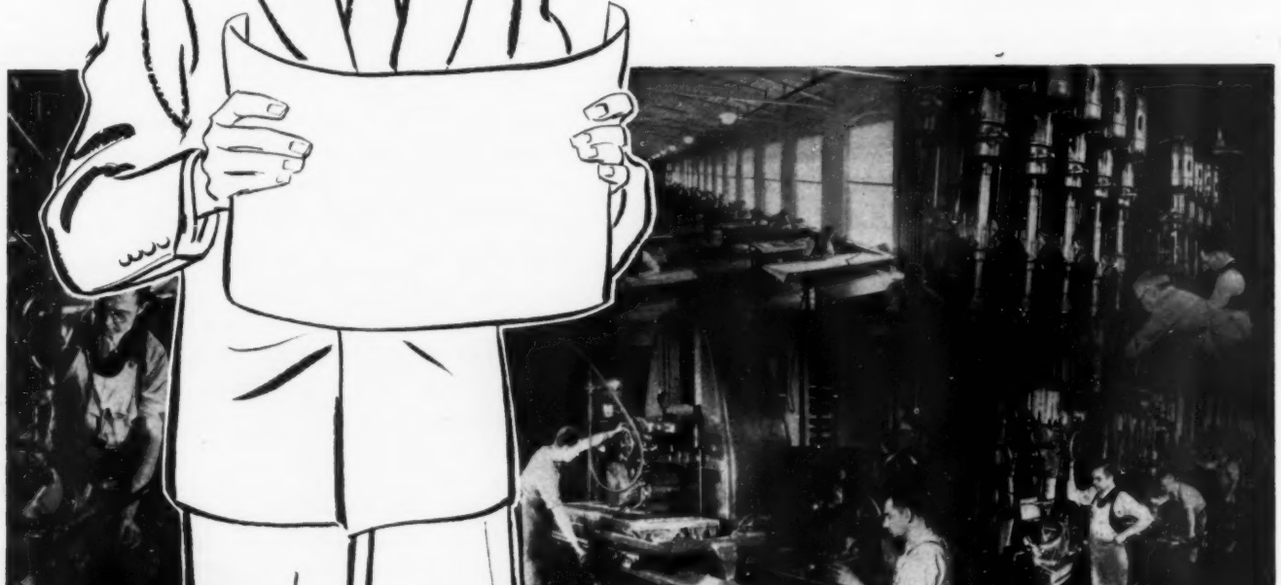
CHEMICALS INDISPENSABLE TO INDUSTRY AND DEFENSE

"Certainly I could use a SUB-CONTRACTOR — but where can I find one for this work?"



FOR more than 50 years, subcontracting has been the sole business of the Taft-Peirce Contract Manufacturing Division. During this time, contracts for every type of machine work have been successfully completed . . . contracts including designing, development, tooling, manufacturing, assembly and shipment. Clients in every industry have used this service, wholly or in part, for jobs ranging from single parts to complete mechanisms in production lots.

This broad fund of experience constitutes a Reserve Bank for manufacturers to draw on, today. To plants facing unfamiliar production problems arising out of defense orders which fall outside of their regular lines of business, Taft-Peirce Contract Service may be able to supply the needed know-how and facilities . . . from our 20 departments manned by skilled craftsmen and equipped with more than 1,000 modern machines. We are still able to do this for our regular clients, and perhaps we can do it for *you*. Write on your letterhead to:

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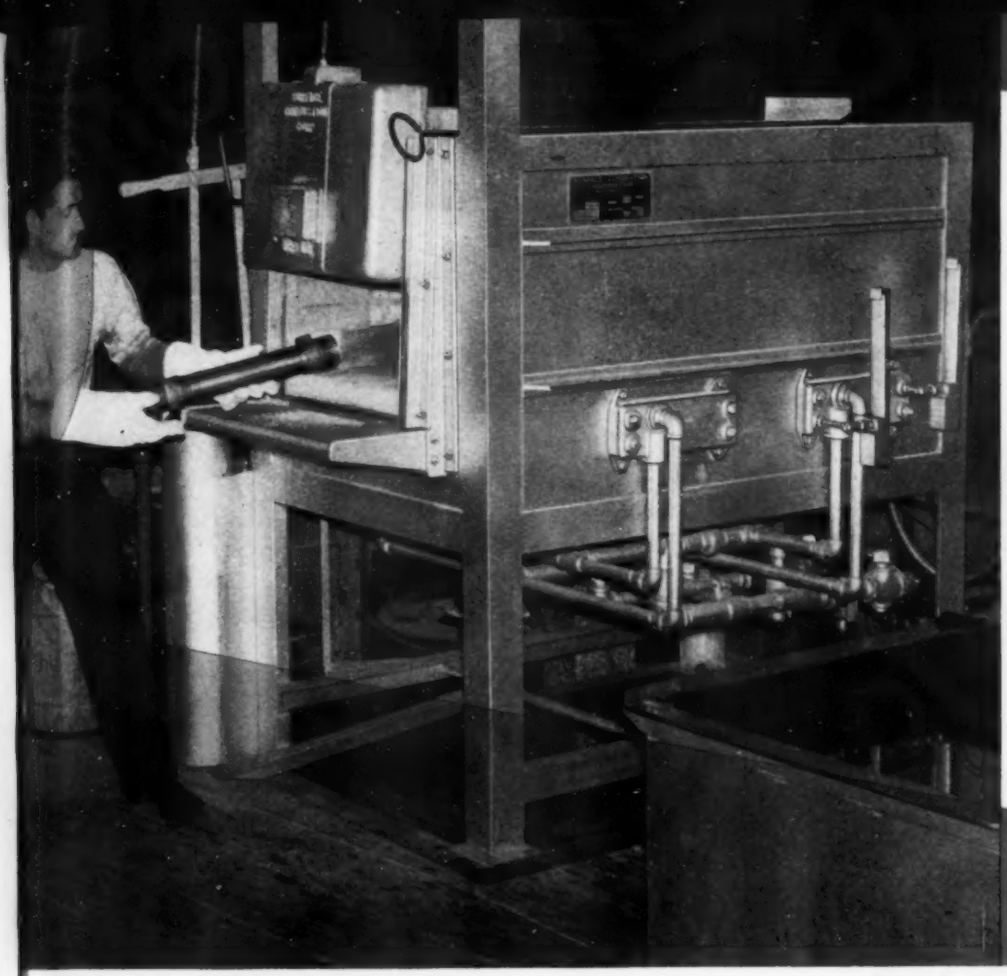

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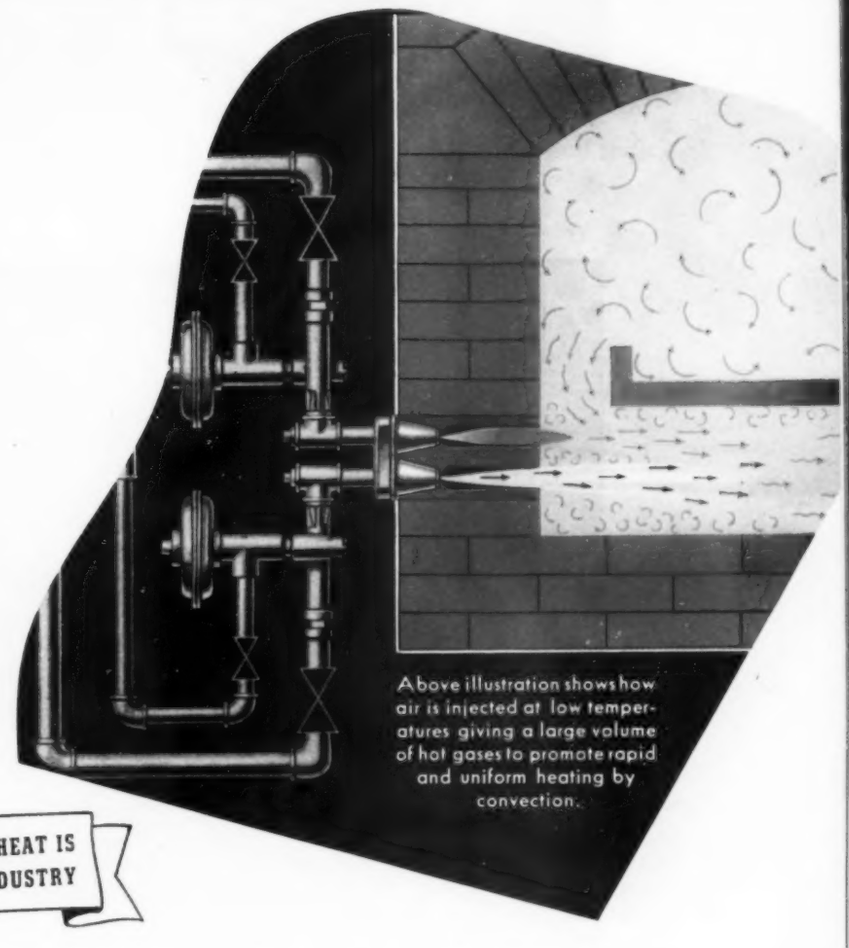
Conjecto-Fired Burners Make Possible High and Low Temperature Furnace

The newly developed SC burner system of Conjecto-Firing—employing unique twin nozzle burners—has made possible the construction of SC Standard Rated Small Oven Furnaces with a wider temperature range and closer temperature control than ever before. At low temperatures, air is automatically injected through one of the twin nozzles to give a large volume of hot gases for uniform and rapid heating—the same principle used in low temperature circulated air or convection heating furnaces.

At higher temperature operations, such as annealing, hardening and normalizing, both nozzles function in the usual manner burning a correctly proportioned gas-air mixture. However, as the temperature of the furnace approaches the desired operating temperature, one set of nozzles is automatically shut off, thus reducing the possibility of over-shooting the desired temperature.

SURFACE COMBUSTION . . . TOLEDO, OHIO

Write for copy of bulletin SC-90A which describes the new system of Conjecto-Firing in detail.



Above illustration shows how air is injected at low temperatures giving a large volume of hot gases to promote rapid and uniform heating by convection.

WHEREVER HEAT IS USED IN INDUSTRY

SURFACE COMBUSTION

35 YEARS

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WITH THE NEW Airco "45"

High Speed MACHINE CUTTING TIP*

. . . A PRECISION TOOL GEARED TO THE DEMAND FOR HIGH PRODUCTION

IN hundreds of field tests, the Airco "45" has demonstrated its capacity to greatly increase production by decreasing the time required to cut metal up to eight inches thick by 20% to 30%.

The Airco "45" High Speed Machine Cutting Tip has a nozzle with a divergent exit portion—a design that permits a narrow, high velocity stream of oxygen, practically free of exit turbulence. A stream of oxygen from the Airco "45" burns away a narrower cut, or kerf, of metal than the conventional tip. As a result of cutting away less metal, the tip cuts faster, precisely and more economically.

Airco "45" High Speed Machine Cutting Tips are at present available in sizes to cut metal thicknesses up to 8 inches. To obtain full value they should be used on oxygen pressures of 85 psi or higher. By substituting a High Speed Tip for the conventional tip in your machine cutting torch you save precious production hours.

*Method Patent No. 1985080

AIRCO

An interesting booklet points out the many advantages that are yours with Airco "45" Tips. Write on your company letterhead for a copy today.

Air Reduction

General Offices: **60 EAST 42nd ST., NEW YORK, N. Y.**

IN TEXAS

MAGNOLIA-AIRCO GAS PRODUCTS CO.

General Offices: **HOUSTON, TEXAS**

OFFICES IN PRINCIPAL CITIES

AIRCO WILSON

Anything and Everything for **GAS WELDING or CUTTING and ARC WELDING**

MACKLIN
GRINDING WHEELS

Macklin Wheels Are Uniform

Uniform grinding wheels must be subjected to sufficient heat to fuse the bond with the abrasive grains. Vitrified wheels undergo extreme heat in continuous and periodic kilns. Scientific and accurate equipment is used to record and regulate heat control to produce highest quality Vitrified wheels, while Resinoid, Silicate, Shellac and Rubber bonded wheels are cured at lower temperatures in electric ovens and are subjected to the same rigid control. Protect Your Production with Uniform Macklin Grinding Wheels.

MACKLIN COMPANY

Manufacturers of GRINDING WHEELS — JACKSON, MICHIGAN, U. S. A.

Distributors in all principal cities

Sales Offices: — Chicago - New York - Detroit - Pittsburgh - Cleveland - Cincinnati - Milwaukee - Philadelphia

A Compact Streamlined BENCH-TYPE Drill Grinder

—a genuine SELLERS grinder

HERE is a small, practical, bench-type drill grinder that embodies the basic principles and the inherent accuracy of the Sellers chuck and the Sellers method of drill grinding. This self-contained machine produces the famous Sellers drill point on one or a million drills in sizes as small as .028" (#70) and up to ½" diameter. It provides drill lips ground with the same inclination to the drill's axis, of equal length and with proper clearance at both center and periphery—the secret of the efficiency of the Sellers drill point.

Pedestal Cabinet for 1-G Drill Grinder

Write for Bulletin on Sellers 1-G Drill Grinder

WILLIAM SELLERS & CO., INCORPORATED
1600 Hamilton Street Philadelphia, Pa.

MODEL 1-G

FOUNDED SELLERS 1848

Sellers

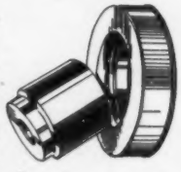
Is CHROMIUM PLATING *Your Answer*

—TO LONGER TOOL LIFE?
—TO MAN-HOURS SAVED?

Here's how to find out!

Do you want to add many hours of productive work to valuable Dies, Gauges and other metal working tools? Want to reclaim oversize or undersize parts? Save man-hours by avoiding breakdowns, resettings and rejects? These advantages—made possible by INDUSTRIAL (HARD) CHROMIUM PLATING for many years—are more vital than ever now.

DRAWING AND PUNCHING DIES



are turning out thousands of *extra* ordnance and essential machine parts every day through being chromium plated. Here are examples of the applications in which vital production and man-hour economies are effected—in drawing and punching copper, brass, nickel and cold rolled steel.

Giving much longer Service

Chromium plated tools often outwear others many times over. In drawing seamless nickel tubing, for example, one manufacturer finds plated dies average 10 times longer life than unplated dies—plated mandrels give up to 20 times the service.

Saving the cost of new tools

Another concern cites the saving in tool steel—plus 90 per cent of the time required for new drawing tools—simply by replating tools when worn—to obtain another long span of service.

Speeding machine output

Production losses through stopping to polish or redress dies are minimized by chromium plating. Seizing and scoring of the tools are also substantially reduced . . . easier and cleaner stripping of the metal is made possible.

MANY OTHER TOOLS!

On Chromium Plated Plug Gauges, for example, greater accuracy is maintained—as much as 15 times longer life obtained. Other tools giving longer life under specific conditions when chromium plated include Broaches, Burnishing Bars, Bushings, Taps, Reamers, Drills, Lathe Centers, Tool Tips, Files, Slitting Saws, Needles, Thread Chasers, Molding Dies.

SALVAGING REJECTS!

By chromium plating oversize or undersize machine or ground parts, many plants are reclaiming rejects instead of scrapping them . . . saving many hours of skilled labor represented in each finished part reclaimed. Even where a fractional percentage of total output can be salvaged, the low cost of chromium plating makes it worthwhile to look into the savings which may be possible.

Prompt Engineering Advice

Advice from U.C. is advice from Chromium Plating Headquarters. Manufacturers, large and small, who need this service for the production of vital war materials will find it readily available under the U.C. licensing agreement. Let us tell you—without delay—how much you can save and how you can save it. Write or wire today.

UNITED CHROMIUM
INCORPORATED

51 East 42nd Street, New York, N.Y. ★ 2751 E. Jefferson Ave., Detroit, Mich.

Waterbury, Conn.

FOR TOUGH CONTINUOUS PRODUCTION WELDING

6 out of 10

UNIONMELT* LICENSEES USE WESTINGHOUSE FLEXARC WELDERS

HOW TO BUILD SHIPS FASTER . . . With the Unionmelt Process ⅛" to 1⅛" plates are butt-welded in one pass at speeds up to 80" per minute. Welds meet all code requirements, too.

4 GOOD REASONS WHY

1. Heavy-duty 1,000-ampere Flexarc A-C Welder was designed especially for use with the Unionmelt Process; 500-ampere model has built-in 100-volt open circuit tap which adapts it for use with the process.

2. Flexarc A-C Welders have single dial current control, quickly preset or changed under load.

3. Built-in capacitor provides high power factor—high efficiency, low kv-a input.

4. Welding transformer design has ample copper and iron to prevent loss of efficiency through "overworking" these parts in heavy current, semi-continuous operation.

SINGLE UNIT COMBINES CONTROL AND TRANSFORMER

SPEED STARTS HERE . . . Flexarc control unit combines both a-c transformer and control cabinets. Nothing to wire on the job. Voltmeter and ammeter shown are optional. Capacitors for improving power factor also optional. Push buttons control current.

J-70353

For today's defense shipbuilding, construction, fabrication and other operations requiring mass production of butt-welds, the Unionmelt* Process is supplying new and faster welding than ever before possible. The process is simple and semi-automatic, producing sound, continuous welds as much as 20 times faster than by other methods. Important in the increasing use of this timesaving welding process is this fact: production-wise Unionmelt licensees use more Flexarc Welders than all other kinds combined!

MORE FACTS FOR YOU

For a complete story on how this team—Unionmelt Process with Flexarc Welders—can help solve your production welding problems, just see your Westinghouse representative—or write Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., Department 7-N.

(*"Unionmelt" is a registered trade-mark of the Linde Air Products Co.)

Westinghouse

FLEXARC A.C. WELDERS

"With GULF ENGINEERING SERVICE we're getting a 'production bonus' from our equipment"

says this Superintendent

● "This report tells a story of improved lubrication practice," says this superintendent. "You'll note that we're getting a considerable increase in plant output by following Gulf Engineering recommendations. This 'production bonus' is the direct result of more efficient operation of equipment and a big reduction in shutdowns and delays."

Production and maintenance reports covering hundreds of industrial operations show that *definite, measurable* benefits are secured with the help of Gulf Engineering Service: maximum protection against machine failures and delays, most efficient machine performance, and minimum power consumption. *Your* plant, too, should get these benefits of the best lubrication practice. Investigate—call in a Gulf engineer today. His thorough training and broad practical experience with equipment similar to yours can go right to work in your plant as soon as you say the word.

The services of a Gulf engineer—and the Gulf line of 400 quality oils and greases—are quickly available to you from 1200 warehouses in 30 states from Maine to New Mexico. Write or 'phone your nearest Gulf office today.

GULF INDUSTRIAL LUBRICATION

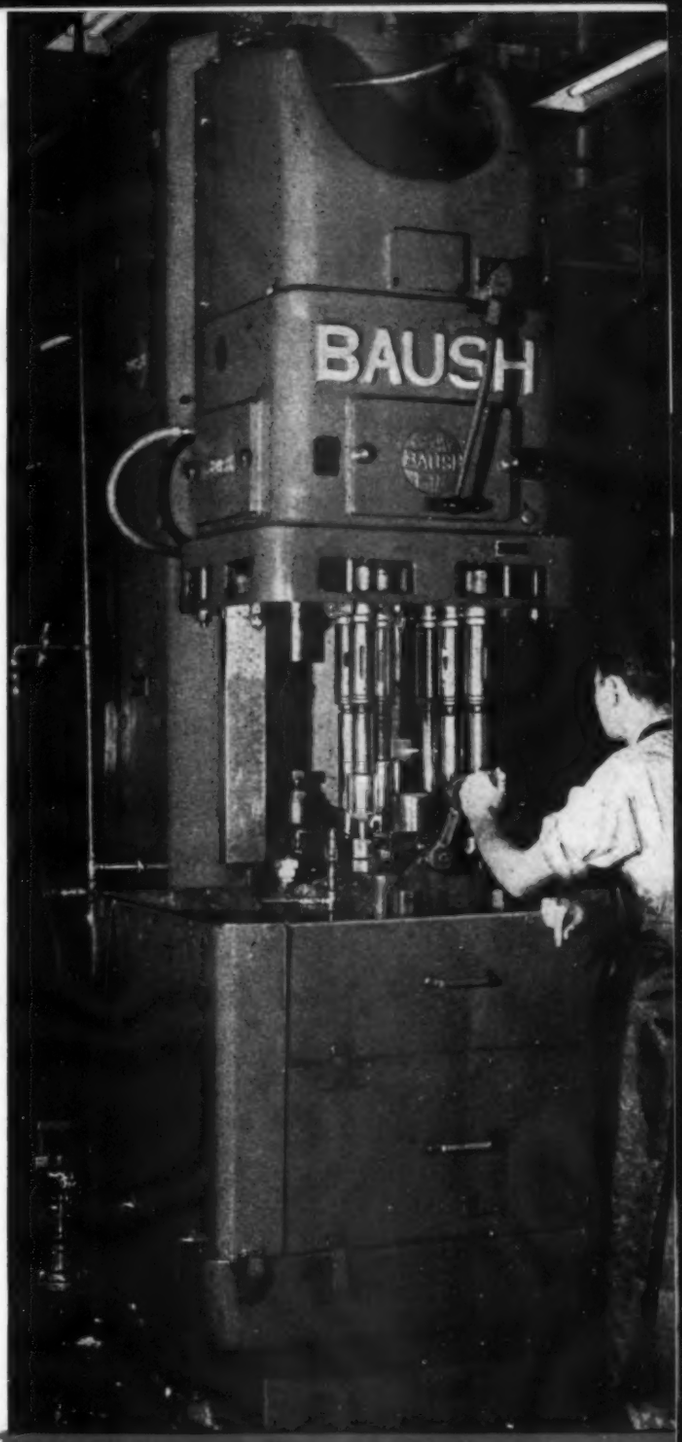
GULF OIL CORPORATION · GULF REFINING COMPANY

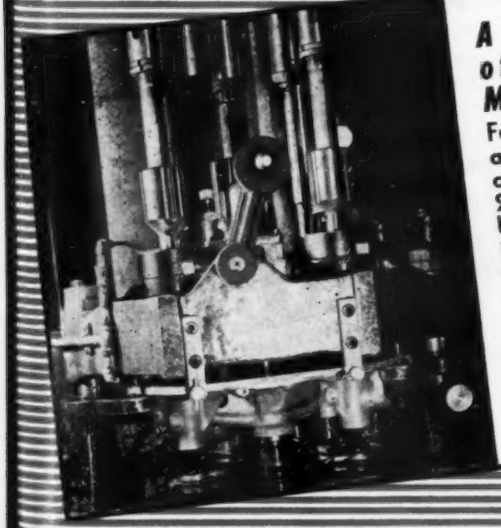
GULF BUILDING · PITTSBURGH, PA.

PRODUCTION INCREASED 600%

Baush Cuts Drilling Time 85% on Vital Part For Wright Cyclone Aircraft Engine

- This Baush W-6 Vertical Hydraulic Multiple Spindle Drilling Machine in Wright Aeronautical Corporation's Cincinnati plant drills the rear cover of supercharger for Wright Cyclone 14, 1700 h. p. aircraft engines.
- The operation consists in drilling 6 holes, 1.842" diameter, from solid in the magnesium alloy casting of which the part is made.
- The Baush Multiple Drill has reduced the operating time on this job from the previous 80 minutes to 12 minutes — speeding production and cutting costs, while maintaining strict accuracy.
- Moreover, this machine operates 16 hours a day, 6 days a week — testifying to Baush dependability. And other Baush machines, easily tooled for a wide variety of drilling, boring, tapping and reaming operations, are on the job at Wright.
- Manufacturers seeking speed today, economical production in the years ahead, rely on Baush.





A Few Features of this BAUSH Multiple Drill

Fully hydraulic. Electrically operated by solenoids. 18" piston stroke. 2 speed change gear box. Push-button starting. Automatically operated feed selector. Automatic stop at end of operating cycle. Counterbalanced drill head. Ways compensated for wear by bronze taper wear strips.

BAUSH

MACHINE TOOL COMPANY

Springfield, Mass. Detroit, Mich.

MEANS BUSINESS

For over 45 years Baush has pioneered in multiple drilling. Expert engineering service available. Send blueprints for analysis.

Give your Taps a "BREAK" or they will BREAK

KEEP them in good condition by sharpening them frequently. Use dulls them as it does all cutting tools and when dull they are likely to chip, break and produce rough or oversize threads.

Here are some suggestions which will help you get utmost service from your taps:

1. The minute a tap begins to get dull, sharpen it.

2. Take light grinding cuts to avoid "burning" the cutting edges.

3. Use a tap chamfer grinding machine, if possible, as it reproduces the original grind accurately. There are several good ones on the market. If you must grind by hand, note the following:

a. As a rule, grind the chamfered portion only. (Note the diagrams which show correct results of grinding and—exaggerated—two common errors.)
b. Have a new tap handy for comparison regarding number of threads chamfered.
c. Use a soft 80 grain wheel.

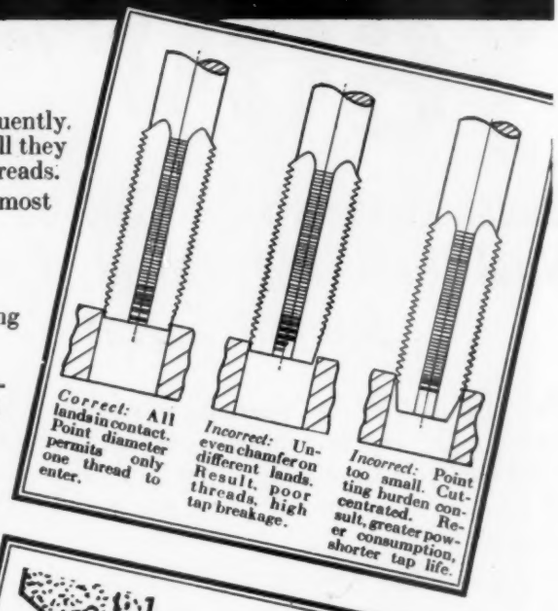
4. If tap needs grinding in flute, to touch up the edges, use a universal grinding machine and a hard 60 grain wheel. Use a saucer wheel for a radial or straight rake and a disc wheel formed to the hook for a hooked rake. (Note the sketches which show how to handle this job.)

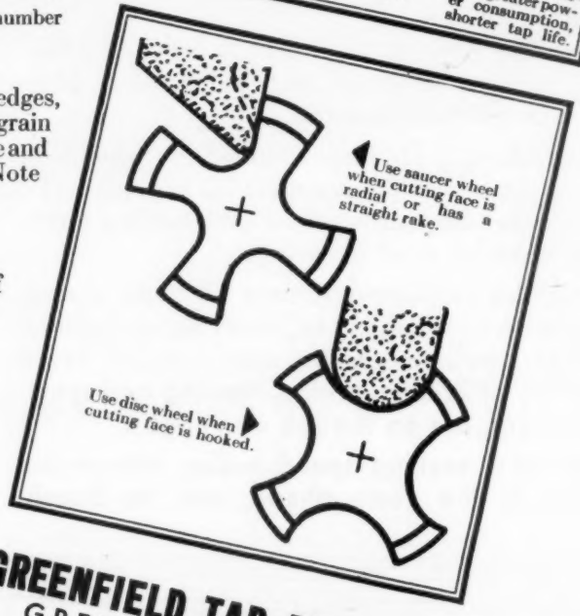
5. Completely grind away any broken teeth.

6. Polish the ground portion after sharpening if you are tapping soft or stringy materials that have a tendency to "load" the tap.

7. Taper Pipe Taps should always be machine ground and mechanically indexed to eliminate tapping out-of-round holes.

Remember that all taps become dull when in constant use. It takes more power to drive them and they often slow down the tapping machine resulting in lower production and excessive tap wear. *Keep your taps sharp.*


Correct: All lands in contact. Point diameter permits only one thread to enter.
Incorrect: Uneven chamfer on different lands. Result, poor threads, high tap breakage.
Incorrect: Point too small. Cutting burden concentrated. Result, greater power consumption, shorter tap life.



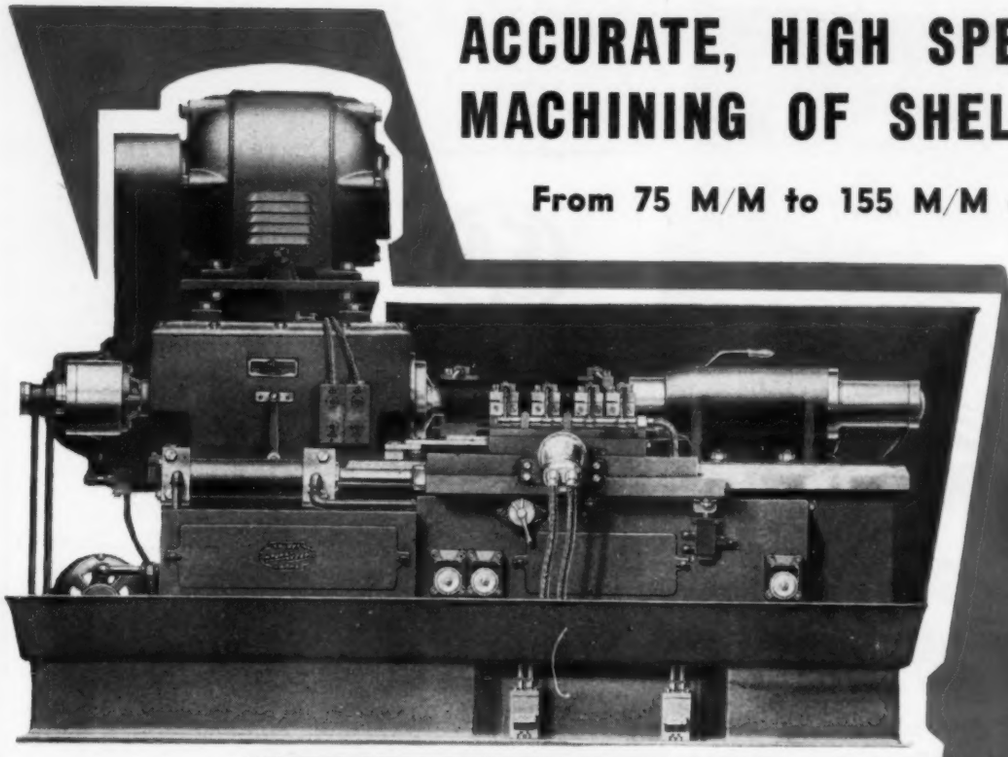
This is one of a series of advertisements published by Greenfield Tap & Die Corporation to help users get greater production from their small tools in these critical times, through making useful facts more widely known

GREENFIELD TAP AND DIE CORPORATION
GREENFIELD • MASSACHUSETTS
DETROIT PLANT: 2102 West Fort St.
WAREHOUSES in New York, Chicago and Los Angeles
In Canada:
GREENFIELD TAP AND DIE CORP. OF CANADA, LTD., GALT, ONT.

GTD GREENFIELD
TAPS • DIES • GAGES • TWIST DRILLS • REAMERS • SCREW PLATES • PIPE TOOLS

ACCURATE, HIGH SPEED MACHINING OF SHELL BODIES

From 75 M/M to 155 M/M assured by



Equipped for automatic operation by the use of hydraulic feeds and hydraulically operated duplex brake and clutch for starting and stopping spindle, the "SPARKS" shell lathe can be depended on for rough and finish machining to close limits of accuracy. Similar work can be handled with equal speed and facility.

SPARKS Semi-Automatic HYDRA FEED LATHE

OPERATION SEQUENCE IN SHELL PRODUCTION

With a lathe battery set up for machining shells, the following operations are handled:

ROUGH TURNING SHELL BODY, FACING BASE END AND CUTTING OFF TO LENGTH—

Shell is held in position by hydraulically operated expanding mandrel engaged in open end of shell and revolving tail stock center. Four tools mounted in front rough body and cut boat tail; two tools on rear face base end and open end.

BORE and CHAMFER, REAM and CHAMFER

Shell is held in hydraulically operated collet and tools inserted in self-indexing hexagon turret. Operations are performed in proper sequence.

Condensed Specifications

Swing over ways—21"

Swing over carriage—12"

4-speed geared headstock

Timken mounted spindle

Motor drive

FINISH TURN OUTSIDE OF BODY AND NOSE CONTOUR TO BOURRELET

Shell is held at open end by hydraulically operated internal driver at base end by revolving tail stock spindle center. Finishing tools front and rear finish turn boat-tail, body diameter to bourrelet, nose contour on ogive to bourrelet, finish turn bourrelet, face base end and band groove.

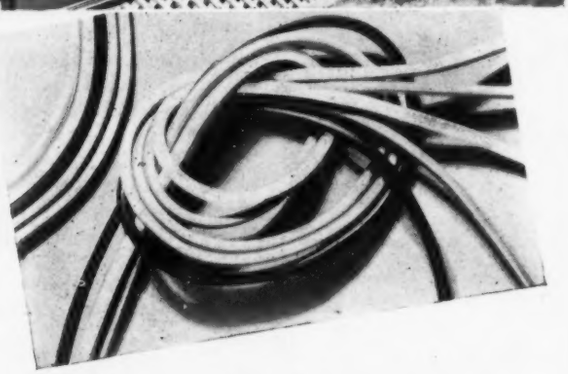
MACHINE BAND and FINISH FACE BASE

Shell is held in hydraulically operated collet. Front tools face base and rough turn band; rear tool finish turns band.

Write for complete details

SPARKS HYDRA-FEED LATHE

SPARKS MACHINE TOOL CORPORATION
NORWALK . . . . CONN.



These tests prove

FLAMENOL WIRE

REG. U.S. PAT. OFF.

ideal for machine-tool wiring

SEEKING a machine-tool wire that would resist damage from splashing oil and coolants, one of the largest automobile manufacturers tested 1000 feet of Flamenol. Here are a few of the tests:

1. They gave it a high-voltage test.
2. They tied it in knots and gave it severe mechanical abuse.
3. They soaked it in a mixture of oil and machine-tool cutting compound.

Flamenol wire passed all these tests. The automobile manufacturer ordered 40,000 feet — later ordered 60,000 feet more — and has purchased to date more than 1,000,000 feet of Flamenol wire. A number of other automotive manufacturers have followed suit — wiring practically all their machine tools with Flamenol — as well as using it in other factory locations, for leads and for panel- and control-wiring.

A choice of 12 colors makes it easy to identify circuits. In addition to being flame-resistant, Flamenol is ink-, oil-, and water-resistant. And it's flexible and easy to install.

Facts about any specific installation that you may want to know about are available from our local office or from *General Electric, Schenectady, N. Y.*

GENERAL ELECTRIC

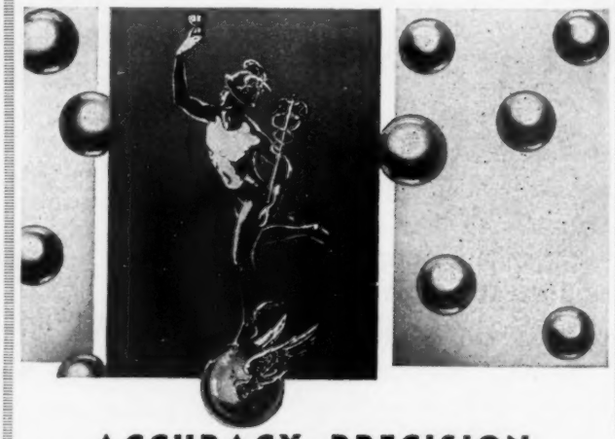
5M2-20-1200

Dead Front, Safety Type Switchfuz Switchboard, with hinged pull-out type units.

Distribution Type Switchboards

are built in a wide variety of types, to meet all industrial conditions — Live Face; Dead Front; Safety Type, Switchfuz, Shutlbrak, or Circuit Breaker . . . They are assembled complete in the factory before shipment, and, as far as possible, are shipped with all apparatus (except instruments) in place . . . Special engineering service is available . . . Quotations will be submitted upon receipt of specifications and complete list of requirements . . . Send for complete catalog data.

Frank Adam
ELECTRIC COMPANY
ST. LOUIS



ACCURACY—PRECISION

All WATERBURY STEEL BALLS are of uniform hardness which extends to the center of each ball. Made of high carbon chrome alloy steel highly finished.

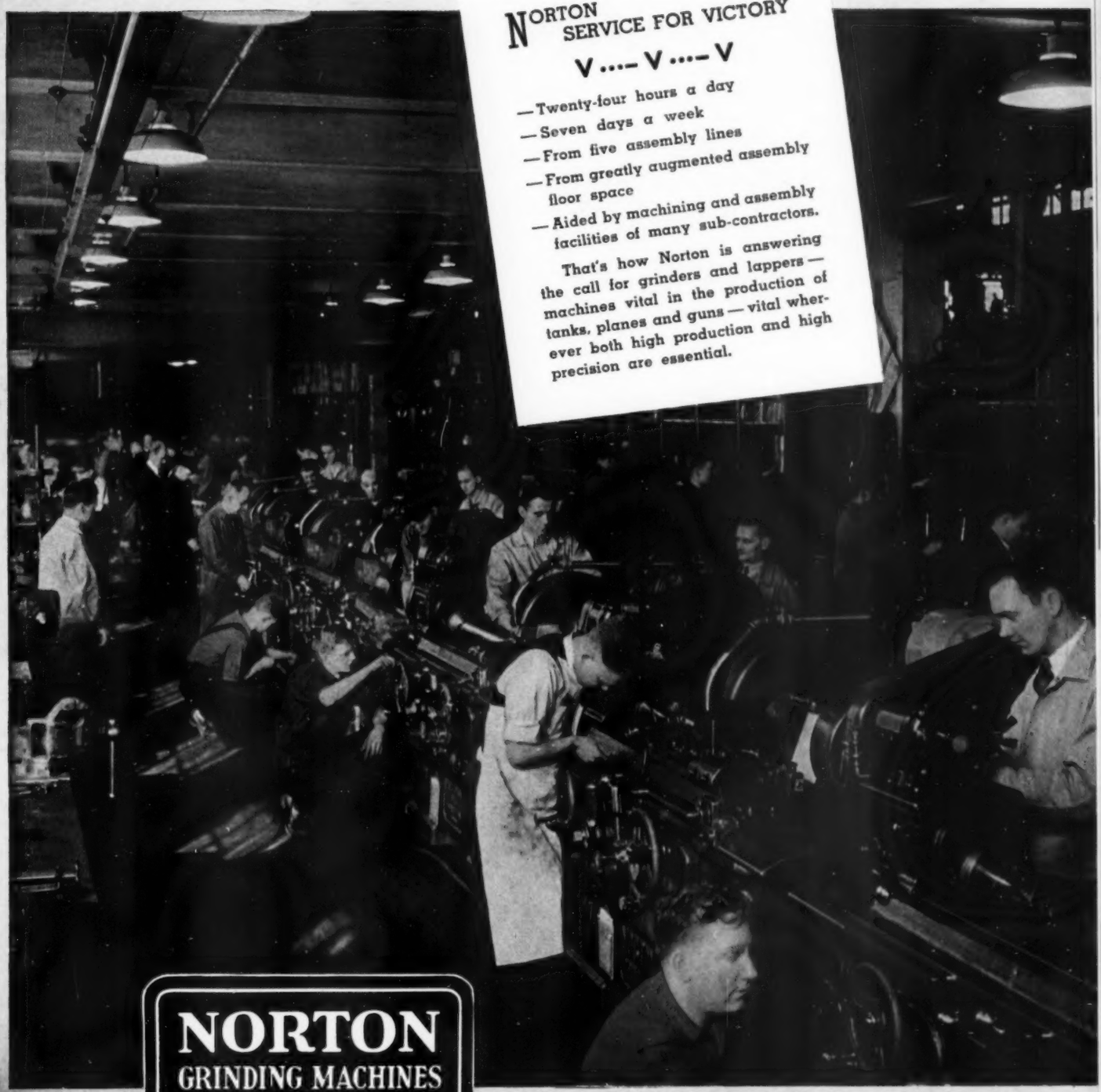
WATERBURY STEEL BALLS

HIGH CARBON, CHROME ALLOY STEEL, BRONZE MONEL METAL, STAINLESS STEEL BALLS, STANDARD, OR SPECIAL SIZES. WRITE FOR COMPLETE INFORMATION.

THE WATERBURY STEEL BALL CO., INC.
Poughkeepsie, New York
Factory: Waterbury, Conn.

NORTON GRINDERS ROLL OFF THE ASSEMBLY LINES

. . . to keep 'em flyin'



NORTON SERVICE FOR VICTORY

V ...— V ...— V

—Twenty-four hours a day
—Seven days a week
—From five assembly lines
—From greatly augmented assembly floor space
—Aided by machining and assembly facilities of many sub-contractors.

That's how Norton is answering the call for grinders and lappers — machines vital in the production of tanks, planes and guns — vital wherever both high production and high precision are essential.

NORTON
GRINDING MACHINES

. . . to keep 'em fightin'

WAR TIME IS NO TIME TO GAMBLE

with your cutting tools

GRIND and Re-Grind Correctly

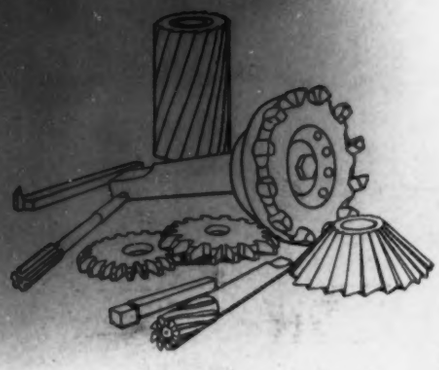
—to keep tools working
—to keep up production
—to keep planes flying
—to keep tanks fighting

Tool Grinding Wheels are essential to every metal-working plant—essential to fast production.

Norton Tool Wheels minimize the gamble—the chances you take with valuable, hard-to-replace cutting tools.

NORTON COMPANY
Worcester, Massachusetts

NORTON ABRASIVES



HERE'S THE RIGHT MATERIAL FOR YOUR ROUTER DIES

AIRCRAFT industries are daily discovering new advantages in the use of Masonite Die Stock for routing templates.

Masonite Die Stock Templates may have greater depth or thickness with a resultant increase in durability and stiffness for the same or less weight because this modern semi-plastic material is one-sixth the weight of steel.

Having added thickness, router dies of Masonite Die Stock sustain less wear and change of contour. Damage from the router shaft collar or guide pin is materially reduced.

There is sufficient thickness to permit the use of Cleco Fasteners or similar clamps for the high-speed fastening of the metal sheets.

Because of the speed, ease and low cost of fabrication with high-speed cutting tools in the Pattern Shop, many manufacturers are using this material to relieve pressure on their steel fabricating sections. Masonite Die Stock may also be processed with metal-working equipment.

The most popular thickness of Masonite Die Stock for router dies is ½" or ⅝" thickness . . . in sizes 48 x 144" or 48 x 72". If you would like further details about Masonite Die Stock, fill out and mail the coupon.

Masonite Router Dies in operation with Radial Arm Router. Courtesy Vought-Sikorsky Aircraft Div., United Aircraft Corporation.

COPYRIGHT 1942, MASONITE CORPORATION

MASONITE CORPORATION *Dept. AM-2, 111 West Washington Street, Chicago, Ill.*

Please send me illustrative literature and complete information about Masonite Die Stock.

*Name and firm*_____

*Address*_____

*City*_____ *State*_____

Prompt Deliveries on...

ACCURATE SURFACE PLATES

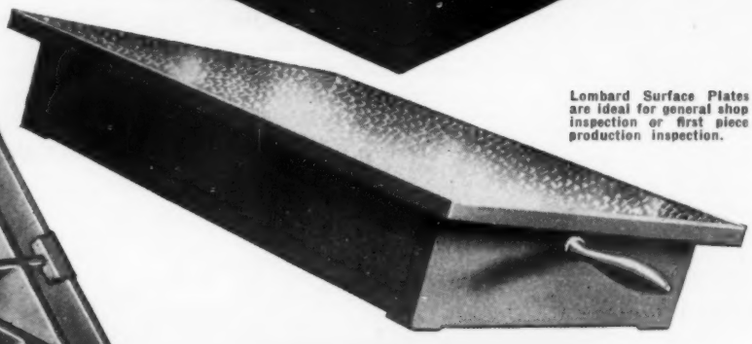
To shops needing high grade, accurate surface plates in a hurry, Lombard offers outstanding opportunities to meet those needs promptly. We are geared to produce these plates to the highest degree of precision where extreme surface accuracy is required.

Lombard Surface Plates are specially heat treated to relieve casting and machine strains. They are of extra rigid and heavy construction and carefully hand scraped to insure the closest limits of maintained accuracy.

Available also with planed and hand lapped surfaces. Standard sizes available as follows:

SIZE	WEIGHT	SIZE	WEIGHT
14"x18"	95	*36"x48"	1150
18"x24"	190	48"x48"	1700
24"x24"	295	*48"x72"	3750
24"x36"	450	60"x72"	4850
24"x48"	900	*48"x96"	6550

*Made to Order only



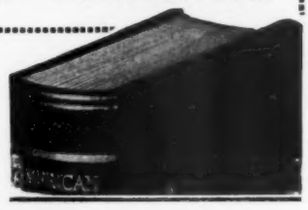
Lombard Surface Plates are ideal for general shop inspection or first piece production inspection.

Extreme accuracy of Lombard Surface Plates is maintained indefinitely through heavy ribbing and 3-point suspension.

WRITE AT ONCE *for Details and Prices*

LOMBARD GOVERNOR CORP.
ASHLAND, MASSACHUSETTS U. S. A.

6 McGRAW-HILL SUGGESTIONS FOR EMERGENCY EMPLOYEE TRAINING



1. MACHINE TOOL OPERATION

A. Part I, Lathe—Bench—Forge, $2.25
B. Part II, Drilling—Planing—Milling—Grinding, $2.75

By H. D. Burghardt. Two volumes presenting basic elements of machine construction, tool grinding, operation, and general shop practice, in simple, understandable way. Widely used in trade schools for 17 years.

2. BLUEPRINT READING

By B. F. Hebberger, and C. Nicholas, Hadley Vocational School. Blueprinting reading as an introduction to shop sketching and mechanical drawing. Instruction problems and questions for building and machine trades. $1.80.

3. PRACTICAL SHOP MATHEMATICS

A. Vol. I, Elementary, $2.20
B. Vol. II, Advanced, $2.20

By J. H. Wolfe and E. R. Phelps. Mathematics that constantly confront the tool maker, die maker, draftsman, in a treatment adapted to vocational school and home-study needs. Several hundred practical problems.

4. AMERICAN MACHINISTS' HANDBOOK

By F. Colvin and F. Stanley. Standard manual of data, methods, and definitions for apprentices, machinists, toolmakers, draftsmen, designers, foremen, and all others connected with shop and drafting room practice in metalworking and allied industries. New seventh edition, $4.00.

5. JIGS AND FIXTURES

By F. Colvin and L. L. Haas. Practical manual on all aspects of design and economical use of jigs and fixtures. Many typical jigs and fixtures in actual use shown, with cost and other data. $3.50.

6. PRESSWORKING OF METALS

By C. W. Hinman. Gives you a complete treatment of die design, including basic designs for all kinds of press-working problems — a head start in adapting your own designs to all types of work, regular and special. Includes use of press accessories and attachments, short-cut calculations and designs, drawing of cartridge shells, practical mathematics of press work, and other features. $4.00.

Examine any of these books 10 days on approval

MAIL THIS COUPON

10 Days' Examination Free—Send This Coupon

McGraw-Hill Book Co., Inc., 330 W. 42nd St., N. Y. C.
Send books encircled below for 10 days' examination on approval. In 10 days I will pay for books, plus few cents postage, or return them postpaid. (Postage paid on orders accompanied by remittance.)

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Company FA-2-42

(Books sent on approval in U. S. and Canada only.)

"Commercial"
ANNULAR BALL BEARINGS

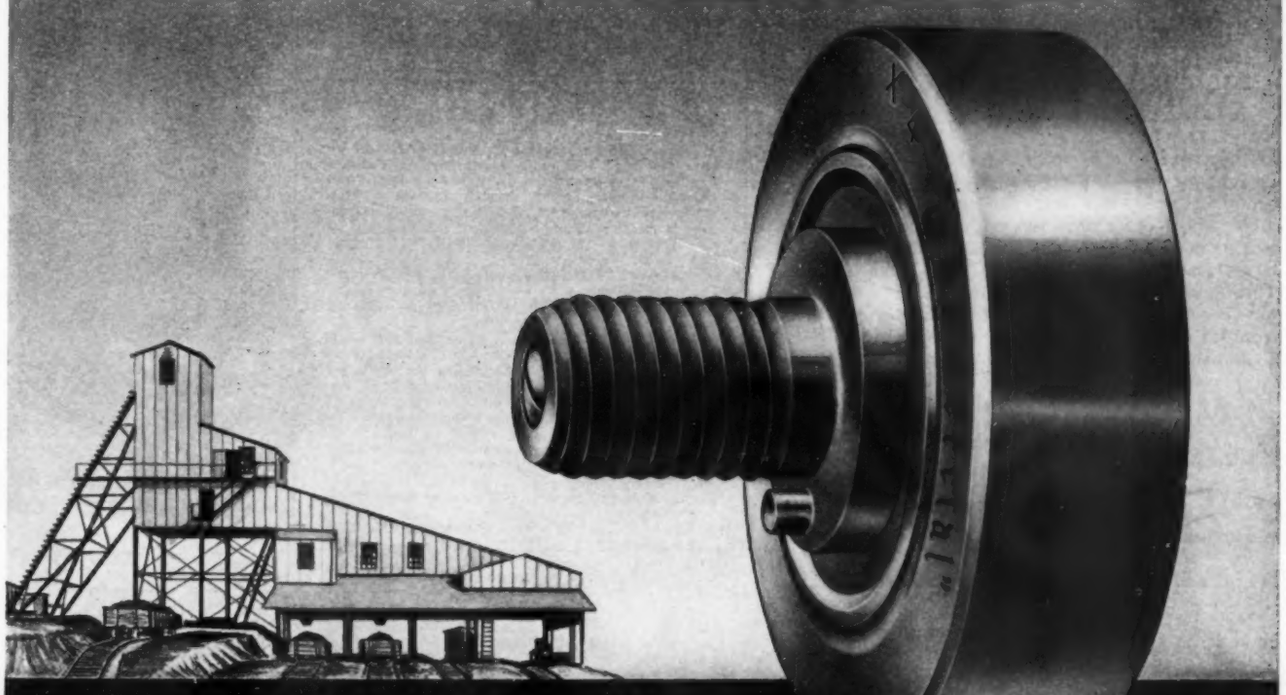
INCREASE PRODUCTION AND EFFICIENCY

"Commercial" Ball Bearings not only help to increase production, but they also bring about substantial savings in time, labor and money. Here, for example, is a specially designed "Commercial" ball bearing roller used in coal conveyor (reciprocating type). This ball bearing roller supports a moving platform running upon a metal track. Platform moves forward slowly: backward, at much greater speed. Coal remains stationary during backward movement.

This is only one of hundreds of different types "Commercial" ball bearings specially designed by us for some specific duty or purpose.

Our Engineering Staff Will Gladly Cooperate

Manufacturers in *every* industry are invited to communicate with our Engineering Staff or write for Catalog and complete details. We will be pleased to submit suggestions or design original installations for your plant machinery or product.



THE SCHATZ MANUFACTURING CO.
POUGHKEEPSIE, N. Y.

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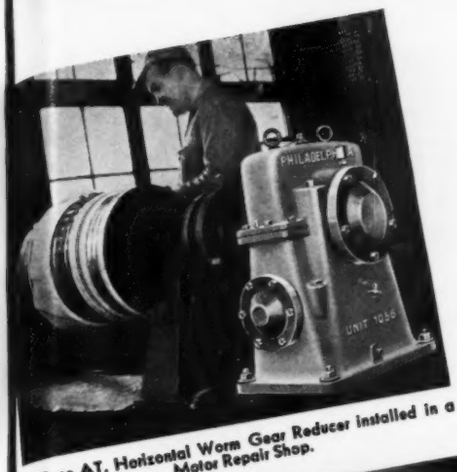

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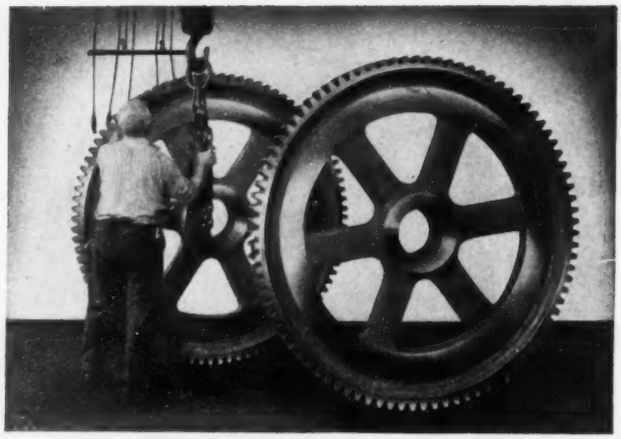

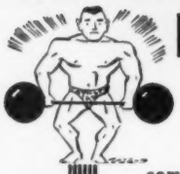

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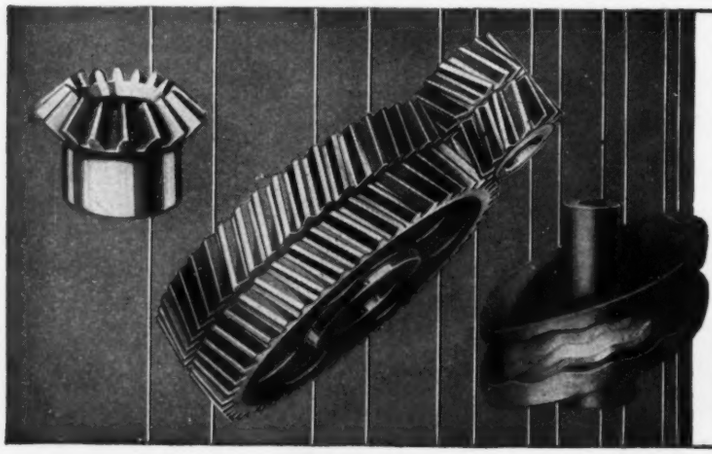

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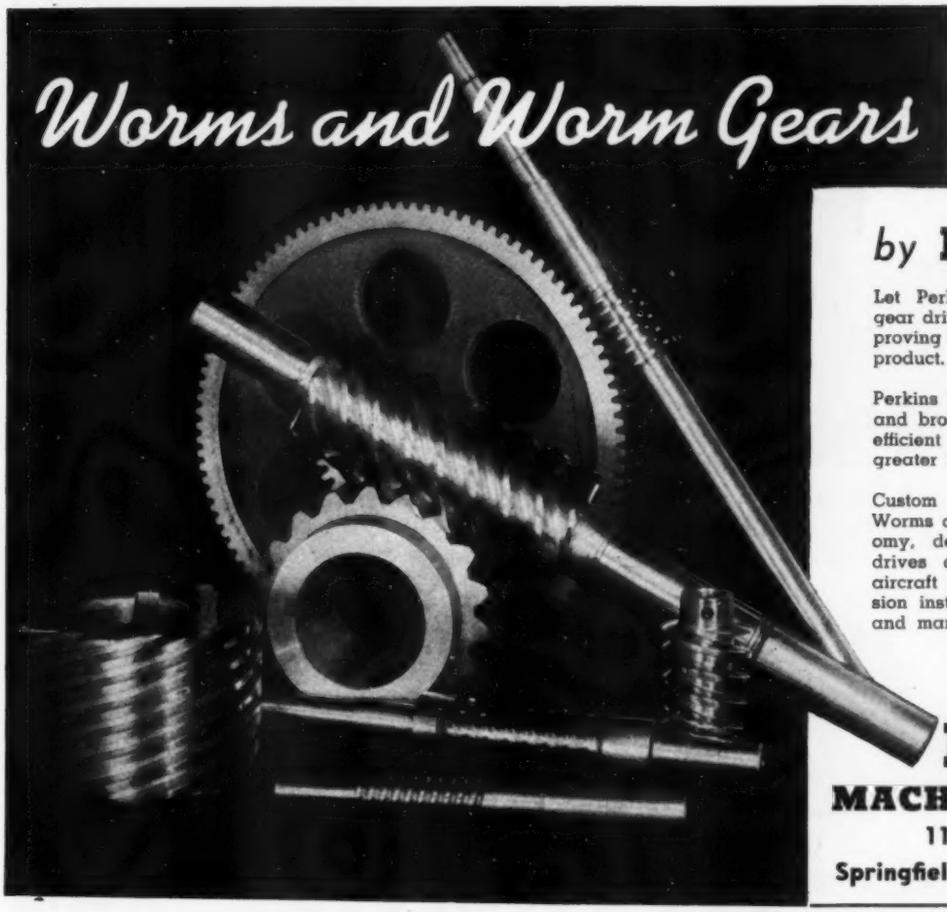

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HAS FLOATING PLATES

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. . . for maximum serviceability in minimum space

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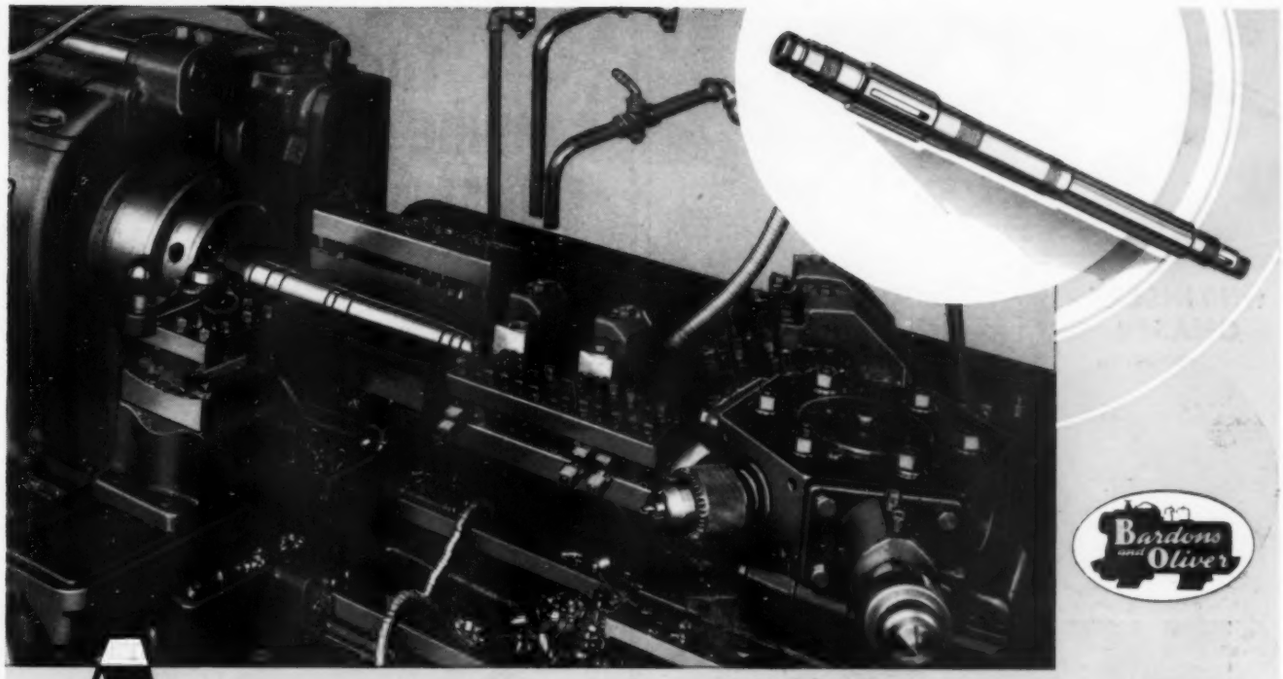

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BARDONS & OLIVER No. 7 UNIVERSAL TURRET LATHE

No doubt about it It's a fine looking machine with plenty of cutting capacity, speed and accuracy

CONSIDER THESE FEATURES AND THE ACCRUING BENEFITS!

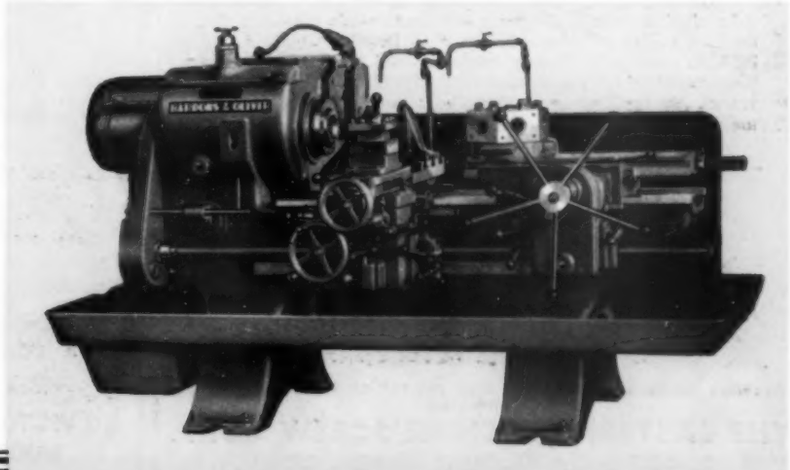
Single Lever Spindle Speed Preselector, hydraulically operated, with spindle brake and reverse to simplify operations for new men.

Abundance of smooth flowing power combined with rigid work drive and tool supports to make possible heavy multiple cutting in tough steel with high accuracy and finish.

Wide enough selection of speeds and feeds for maximum operating efficiency.

Hardened alloy steel ways on Bed, Turret Slide, and Saddle insure lifelong accuracy.

Get all the facts—send for catalog giving full details.



BARDONS & OLIVER, INC.
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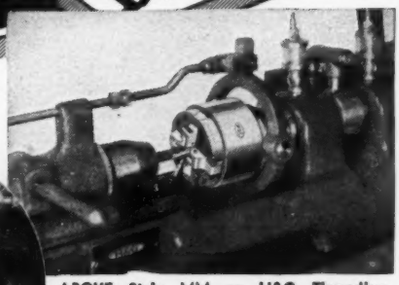
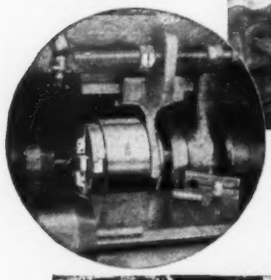
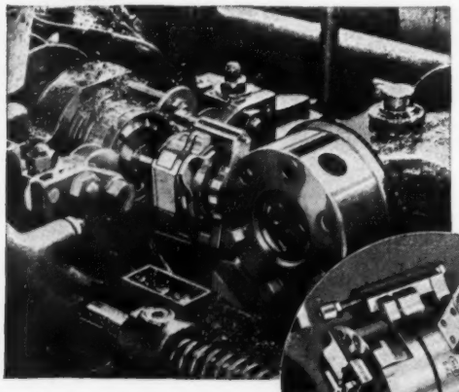
H&G DIE HEADS

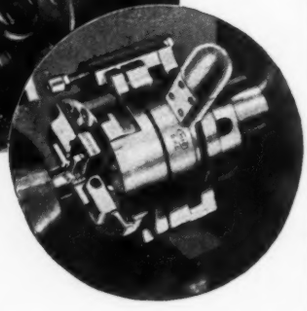
with INSERT CHASER





ABOVE—Style MM on H&G Threading Machine. Ideal for any threader as chasers can be changed by inexperienced operators without adjustments.
LEFT—Style MM Rotary on Gridley Automatic. High net production because there's no appreciable down time lost regrinding chasers or making adjustments.





ABOVE—Style DM on Brown & Sharpe Automatic, Production, 1,000 pieces per hour.
RIGHT—Style DMS for Turret-Lathes. Note provision for front and trip. Ideal for threading to a shoulder.

For Bigger Net Production

• REDUCE MACHINE DOWN TIME •

In all this Defense Program one fact stands out—it is the decided preference there is for H&G INSERT CHASER DIE HEADS, especially among operators and production executives in AIRPLANE plants, AUTOMOTIVE and ARMAMENT works. Everywhere you find these super thread cutting tools standing up to the toughest stocks 24 hours a day.

There are several reasons for standardizing on H&G Die Heads—low cost of chasers per set; simplicity of changing from one set to another set of chasers—less down time—seldom over a two-minute job; unvarying quality of the threads.

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Price $1.00 Each In Any Size

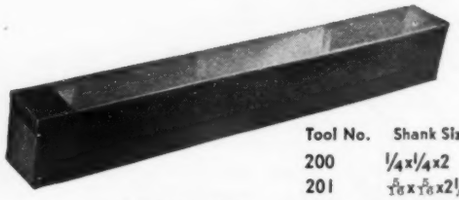
New Low Prices — Increase Production — Cut Operating Costs

Tools are tipped with Tungsten Carbide, and are suitable for machining cast-iron, brass, bronze, aluminum, non-ferrous materials such as hard rubber, bakelite, fibre, and tough alloy steels up to 500 Brinell hardness

Left Hand-Reverse Image. Right Hand Shown

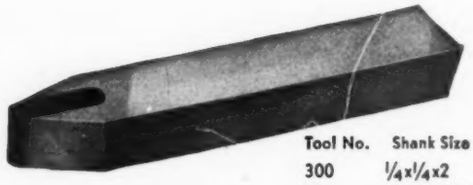
SERIES 100

Tool No. RH	Tool No. LH	Shank Size
R-100	L-100	1/4x1/4x2
R-101	L-102	5/16x5/16x2 1/4
R-103	L-104	3/8x3/8x2 1/2
R-105	L-106	7/16x7/16x3
R-107	L-108	1/2x1/2x3 1/2



SERIES 200

Tool No.	Shank Size
200	1/4x1/4x2
201	5/16x5/16x2 1/4
202	3/8x3/8x2 1/2
203	7/16x7/16x3
204	1/2x1/2x3 1/2



SERIES 300

Tool No.	Shank Size
300	1/4x1/4x2
301	5/16x5/16x2 1/2
302	3/8x3/8x2 1/2
303	1/2x1/2x3 1/2

Standard Tungsten Carbide Tipped Tool Bits

In lots of 12 assorted in any Series; 100-200-300 Series an extra 10% will be allowed; also in lots of 50 assorted 20% discount will be allowed.

Sizes not listed as well as special TIPPED TOOLS will be quoted upon request. When ordering, state tool number and quantity desired.

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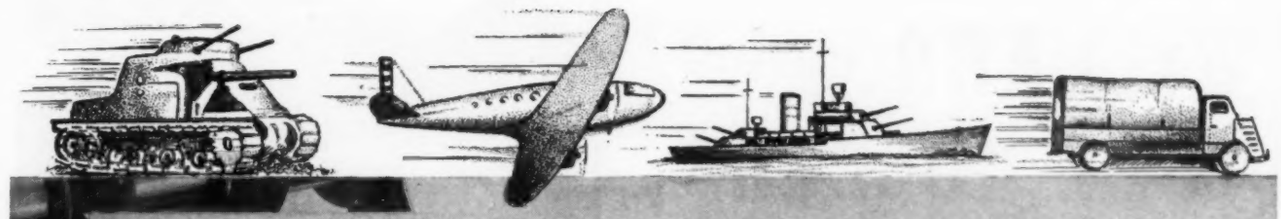

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These great power transmitters pass along *all* the power of drivers to production machinery. No slips, no wasted power—Morse Roller "Channel-Lubricated" Chain drives deliver power with constant efficiency. They're rugged, long-lived, reliable. Worries about frequent maintenance or repair shutdowns end with the installation of Morse drives.

On many machines, in many plants, the change to Morse Roller Chain drives has boosted production to new highs, set new records for sustained productivity. First cost is low — maintenance costs are lower, due to the exclusive long-life features not available on less satisfactory drives!

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Wear stays out!
Heart of the Morse Roller Chain is protected with a life-preserving film of oil, flowing there through channels from the bushings. Oil gets in—wear stays out!

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MORSE *positive* DRIVES

MORSE CHAIN COMPANY ITHACA N. Y. DIVISION BORG-WARNER CORP.

WILLARD Spring TOOL HOLDERS

FINER QUALITY WORK AND FASTER CUTS—ASSURED WITHOUT CHATTER OR DANGER OF TOOL BREAKAGE . . . . . .

Willard Tool Holders have been specially developed to save time and insure precision on high production repetitive work such as that demanded in shops busily engaged in AUTOMOTIVE, AIR CRAFT and DEFENSE MANUFACTURING.

They are available for a wide number of operations and hold tools securely against chatter. Cutter breakage is eliminated and the possibility of damaged work reduced to a minimum.

PROMPT DELIVERIES

Write today for descriptive folder which gives details on Willard Tool Holders for Forming, Threading and Forming Tools, Cutting Off Tools and Threading Tools.

Cutting-off Tool Holders reduce cut off time in half over solid tools. Spring feature makes faster feeds and heavier cuts safely possible.

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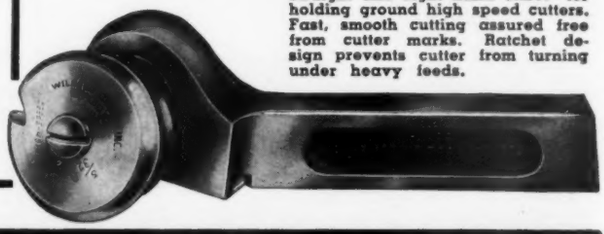

Forming Tool Holders — with straight and right hand offset—for holding ground high speed cutters. Fast, smooth cutting assured free from cutter marks. Ratchet design prevents cutter from turning under heavy feeds.

Product of **AUTO-ORDNANCE CORPORATION**

Manufacturers of THE THOMPSON SUBMACHINE GUN

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upholds CONTINUITY OF PRODUCTION

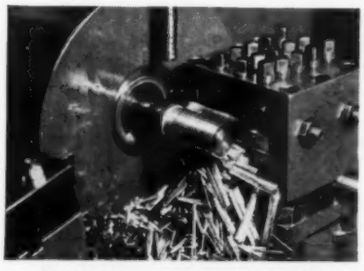
STRAIN on the industrial machine increases; maintenance requirements are mounting in quantity and urgency. The largest manufacturing plants in the country would have to shut down within a few days, if the flow of consumable supplies through local Distributors were stopped.

BUT the wheels keep turning — *continuously* — because the Distributor upholds a marketing system that WORKS. *His* wheel — the mill supply house — connects supply and demand; links the capacity of the one to the needs of the other in a high-geared mechanism of production.

The Allen Mfg. Company ★ ALLEN ★ Hartford, Conn., U.S.A.

OSTER NO. 601 *Simplified* TURRET LATHE performs 1st and 2nd operation work on 20, 37 and 40mm shells

Oster No. 601 equipped with six position turret having six tapped holes in each face for mounting a wide variety of tool holders.



Heavy forming cuts are made possible by the smooth flow of power supplied by the WORM DRIVE. (For high speed work on small diameters and with non-ferrous metals, No. 601 is available with DIRECT DRIVE.)

Holders of shell contracts in the 20, 37 and 40 mm range are using batteries of Oster No. 601 Turret Lathes for 1st and 2nd machining operations. New men are trained rapidly, due to the SIMPLIFIED design and operation of the No. 601. Brief description of the machine follows:

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PRICE? *Under $2000 (less tools).* DELIVERY? *From 10 to 12 weeks from receipt of order and priority certificate.* Write for illustrated Catalog No. 27-A. An Oster Dealer is near you for quick cooperation.

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BY FRED H. COLVIN

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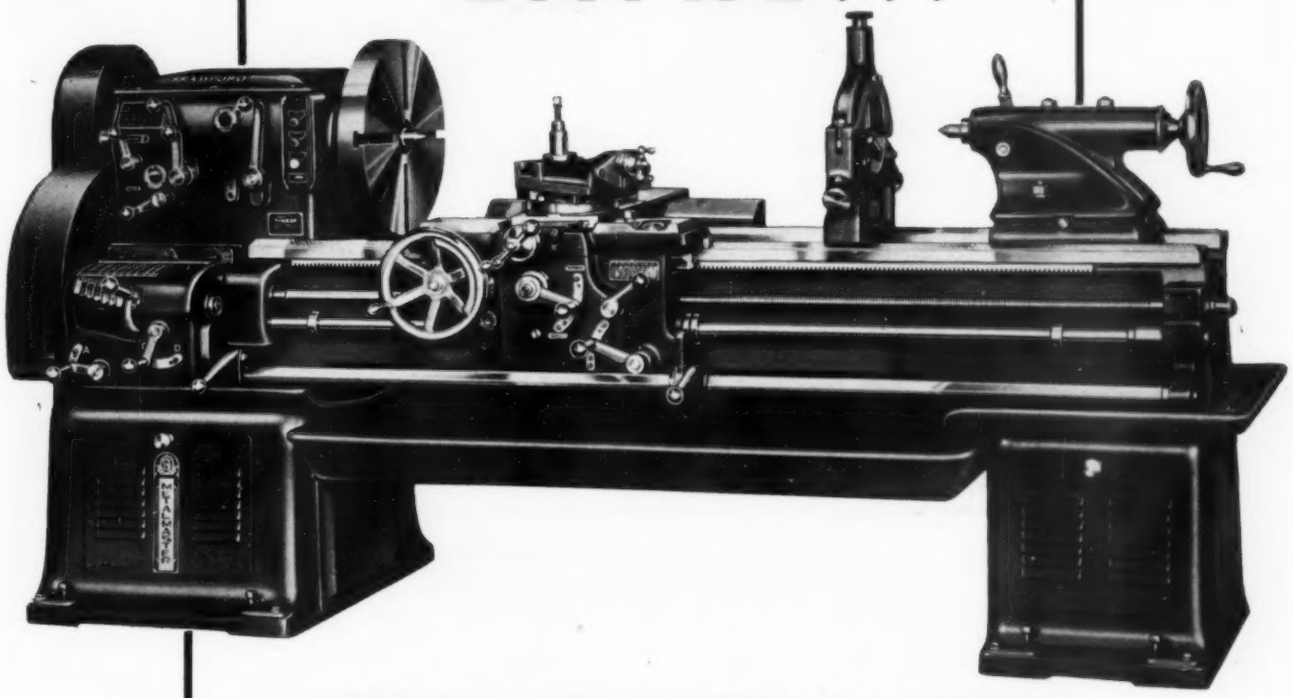

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12″ x 10′
12″ x 12′
12″ x 14′
14″ x 6′
14″ x 8′
14″ x 10′
14″ x 12′
14″ x 14′
14″ x 16′
16″ x 16′
16″ x 8′
16″ x 10′
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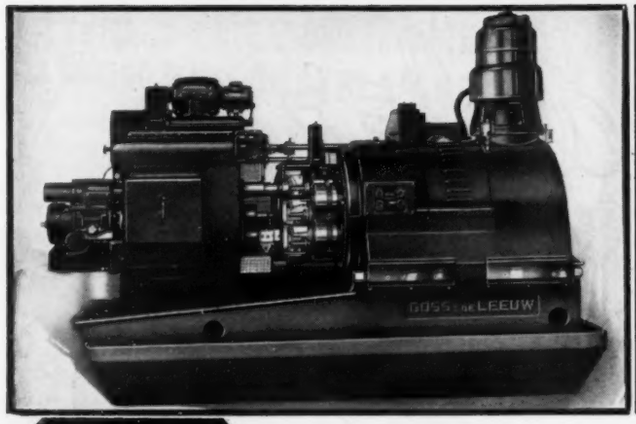

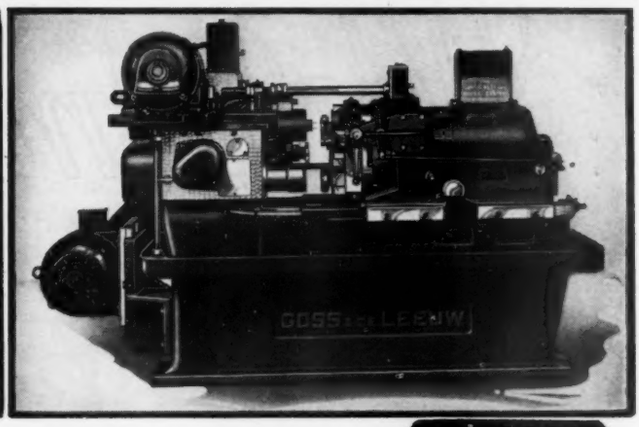

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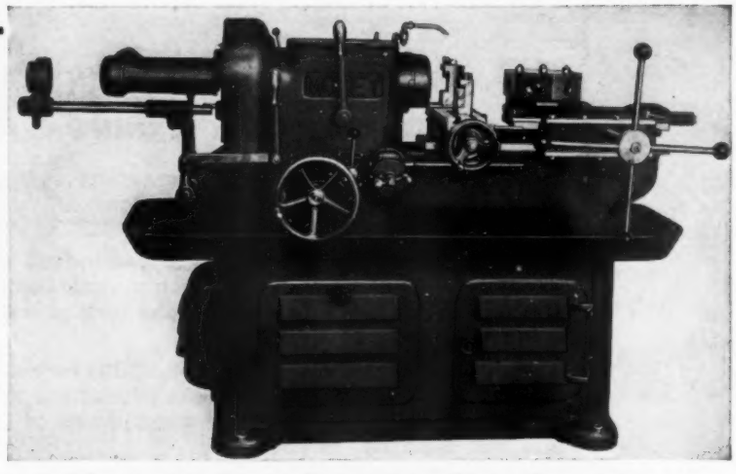

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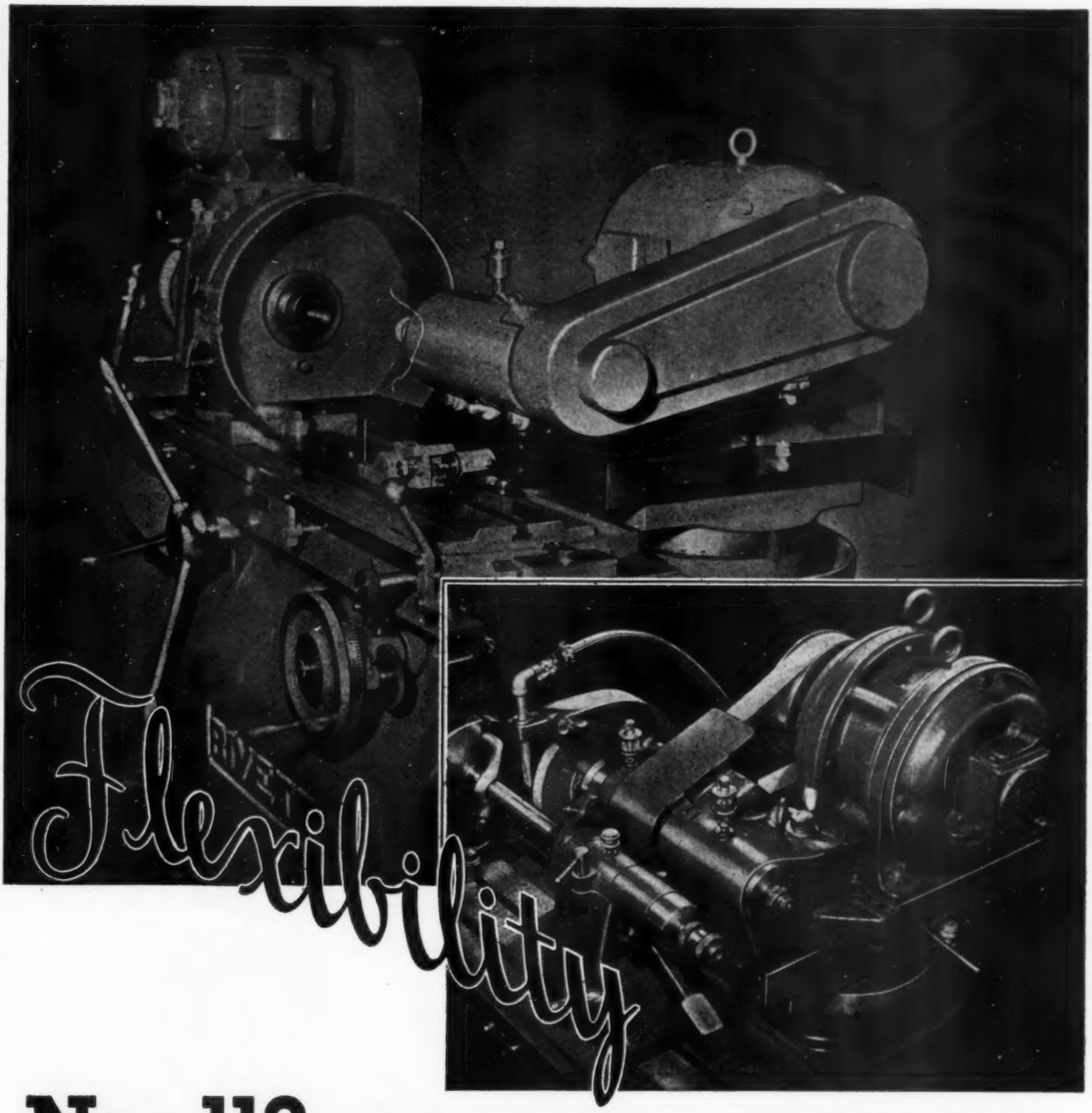

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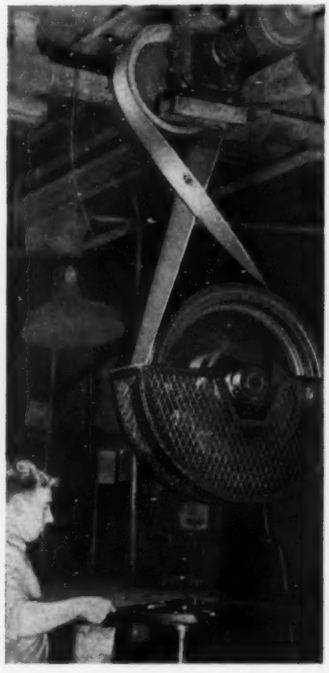

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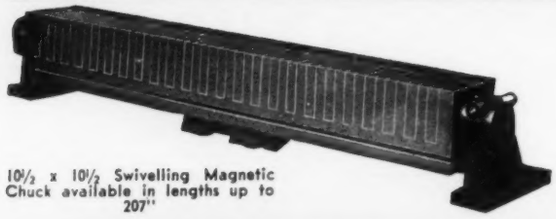

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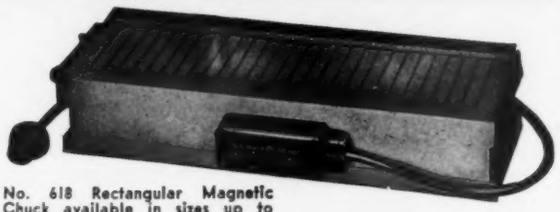

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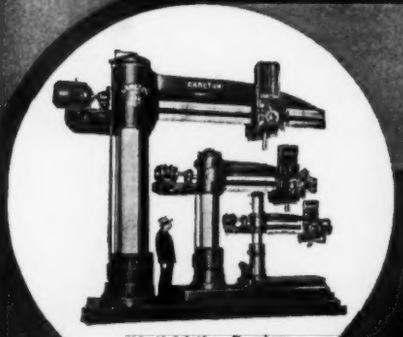

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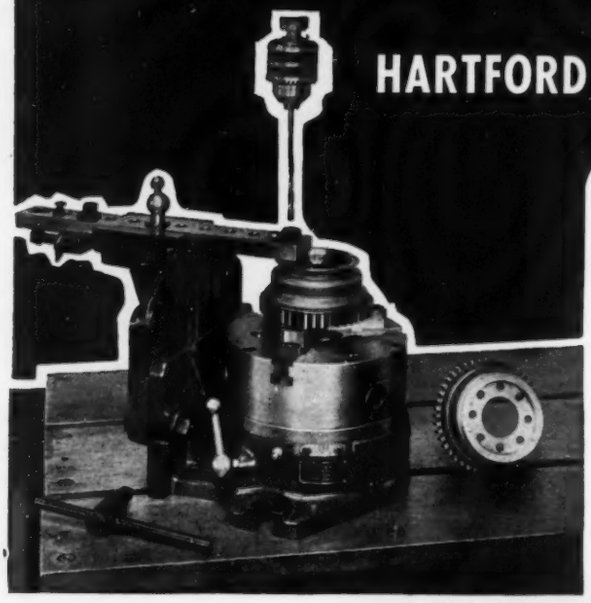
by putting the HARTFORD SUPER-SPACER to work . . .



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Many opportunities for time savings are offered with the HARTFORD SUPER-SPACER—on work involving single pieces or in large quantity production. With this improved spacing device you can step up milling, drilling, slotting and planing operations, because the secure holding assured by the SUPER-SPACER enables you to take full advantage of higher speeds and feeds on indexing work. Accuracy under heavy cuts is also assured. All chance of error is eliminated by mask plates.

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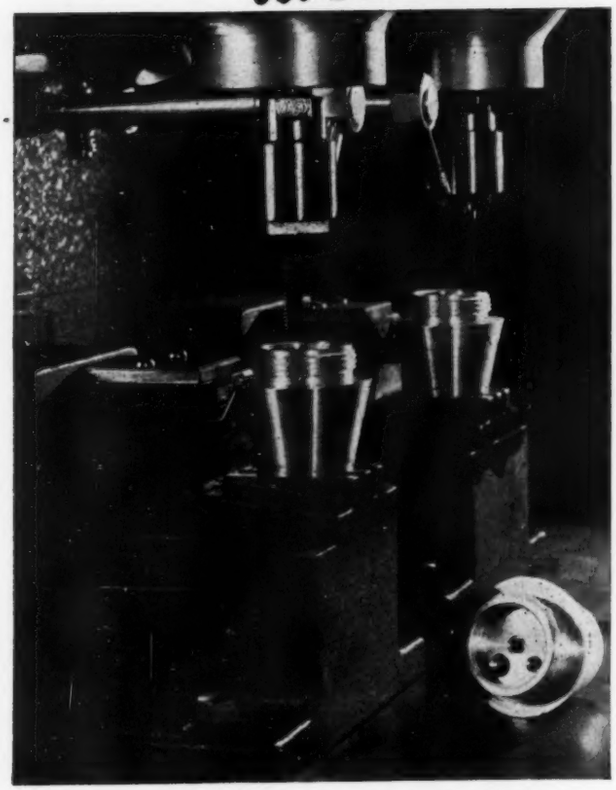

Tooled today for war time aluminum fuse bodies, this *standard* Haskins Tapper can quickly and inexpensively be changed over to peace time production needs.

It's natural today to think of machinery in terms of *immediate* output. But when the war's over—what then?

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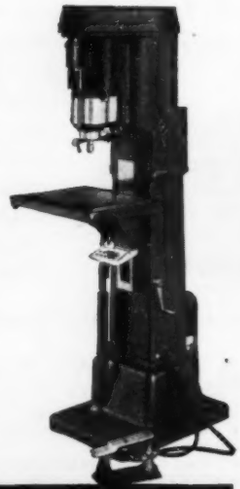

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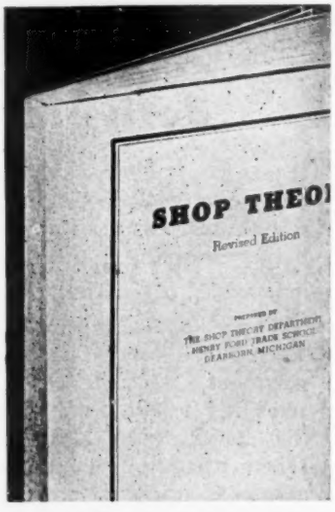

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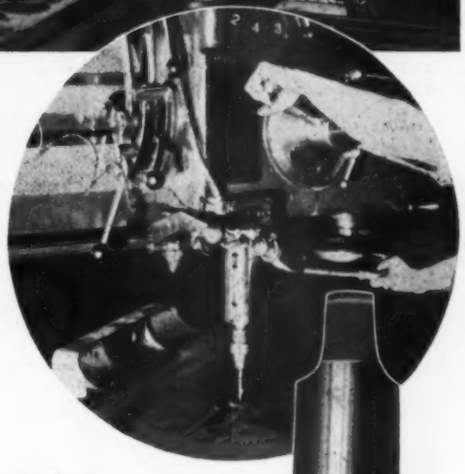

These views taken in the plant of Pratt and Whitney, Hartford, Conn., show a MODERN-MAGIC CHUCK in use on a high speed Radial Drill.

At Pratt and Whitney, and in many other plants working at top production speed, they know that MODERN-MAGIC chucks pep up production by reducing the idle time of revolving spindles to practically zero. Here's the way to keep spindles revolving while tools are being changed and thus cut down on unproductive time.

MODERN-MAGIC CHUCKS make multiple spindle machines out of single spindles—provide for the fast handling of operations in sequence. On turret lathes, too, they virtually add extra stations to your machines.

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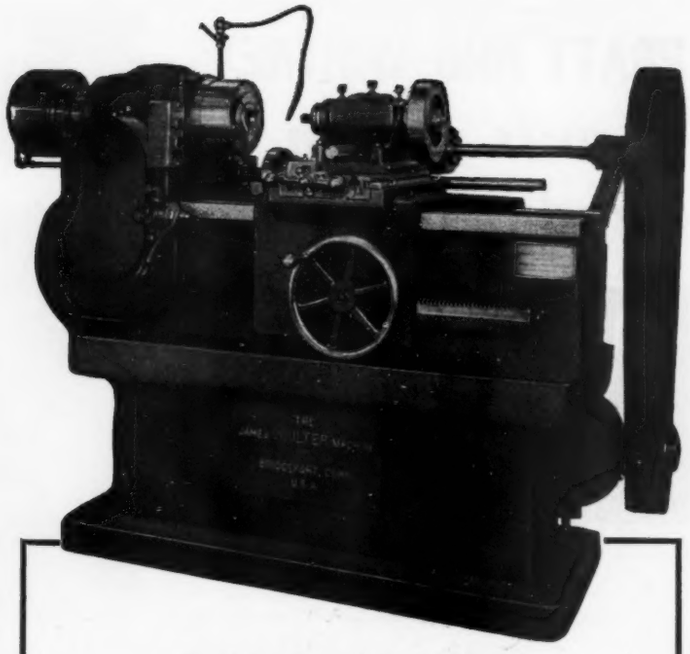

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CARD MACHINE SCREW TAPS

Carbon and High Speed Steel

Manufactured in Regular Type in 2, 3 or 4 flutes according to size and in Spiral Pointed Type in 2 flutes.

Both Regular and Spiral Pointed Types are furnished with National form of thread. Regular Type furnished in taper, plug or bottoming styles; Spiral Pointed furnished in plug style only. Furnished in Carbon, High Speed cut and High Speed Ground Thread.

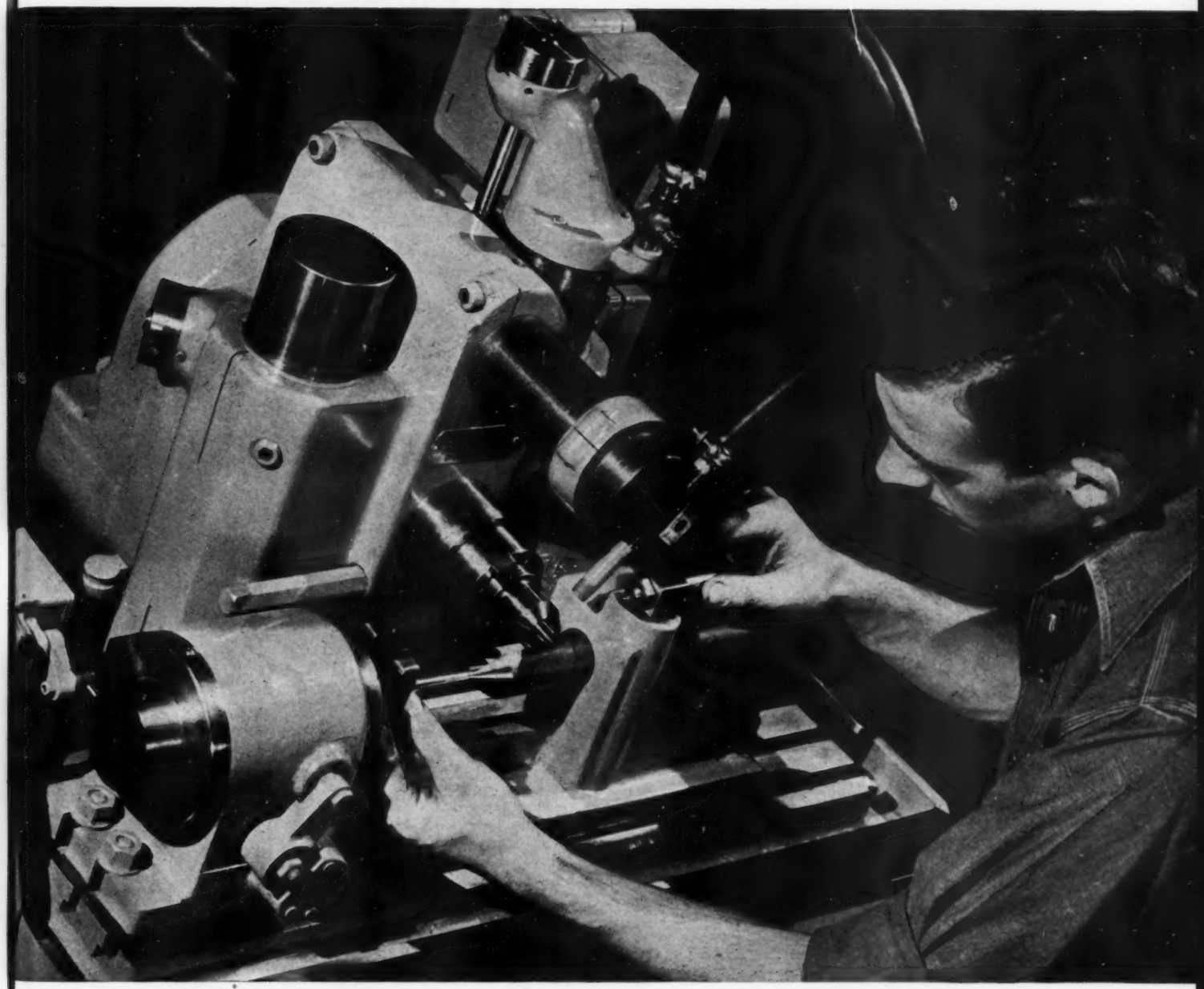
Put Card Machine Screw Taps to work and their performance will convince you of their economy. You'll find sizes listed in the Card Catalog No. 34, pages 32-37 Circular covering recommended uses available on request.

Leading dealers carry the Card line

S. W. CARD MANUFACTURING CO.
Mansfield, Mass., U. S. A.
DIVISION OF UNION TWIST DRILL CO

STORES: New York: 61 Reade St., Chicago: 11 S. Clinton St.
Detroit: 6540 Antoine St., San Francisco: 121 Second St.
Seattle: 568 First Avenue, South
Los Angeles: 524 East Fourth Street

PRODUCTION *plus accuracy* WILL WIN THIS WAR



Get Both in KENT-OWENS

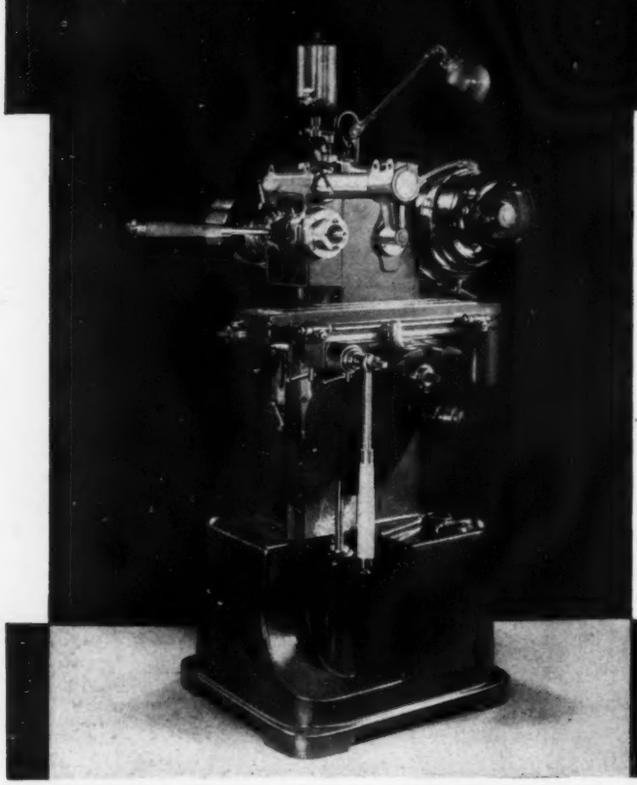
Milling Machines

Production will win the War... *But ACCURACY cannot be sacrificed!* And everywhere experienced shop men are calling on Kent-Owens for milling machines to do the tough jobs. Kent-Owens Milling Machines are *rugged... simple... efficient.* They provide the advantages and features that practical men want. Send for Bulletin... Kent-Owens Machine Company, Toledo, Ohio.

Precision, Sturdiness, High Production and Long Life

are combined in the

NICHOLS HAND MILLING MACHINE



Fast, close work on parts milling is assured by the Nichols Hand Miller. Ruggedness and in-built accuracy place this machine in the class of a modern production tool.

Valuable time savings, especially in tool room service, are offered by the "NICHOLS" because of its compactness and quick, easy set-up. Precision and outstanding versatility contribute also to the adaptability and productivity of this modern machine for tool room use.

An important feature of design which extends the utility and convenience of the Nichols Hand Miller is the vertical head. Operated by hand, the head can be locked in any position. It is also fitted with hand set depth stop. In addition to carrying the spindle, the head supports the heavy overarm for supporting cutting arbor.

Other features of this machine which has longitudinal and transverse feeds of 10" and 7" respectively are fully described in bulletin available promptly on request.

Send for Illustrated Bulletin, giving complete information

W. H. NICHOLS & SONS
WALTHAM, MASS., U.S.A.

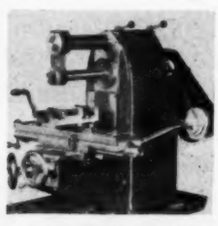
POWER For Heavy Cuts!

One H.P. motor on Vernon No. O Mill supplies ample power for milling steel, cast iron and other tough metals besides the lighter alloys commonly used in today's defense work. Double Vee belt to spindle transmits power efficiently...eliminates belt slippage even on heavy, slow-speed cuts.

WIDE VERSATILITY

High speed production and difficult setup utility are increased by many accessories especially designed for the Vernon No. O Mill . . . all available as standard extras.

COOLANT SYSTEM – 1/10 H.P. splash-proof motor drives gusher type pump, providing large, steady volume of coolant. Chip strainers are located in return circuit. Unit includes all necessary fittings.



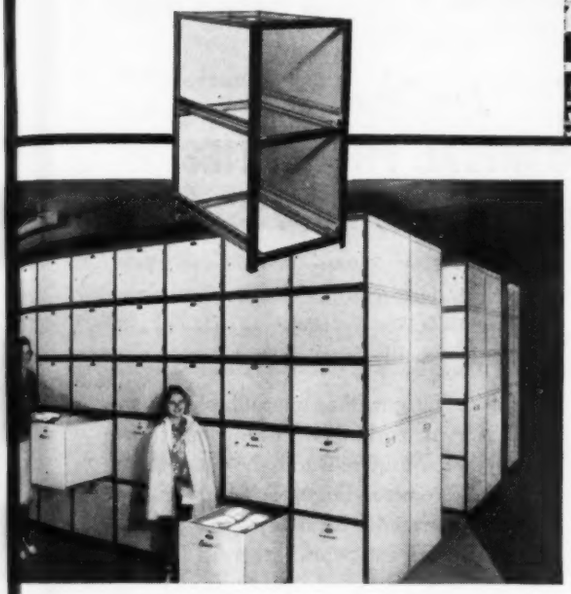
LONGITUDINAL POWER FEED—Permits operator to attend more than one machine on production jobs—saves time... assures uniform cutting...makes smoother finish on all work. Driven direct from spindle. 3 table feeds available.

UNIVERSAL VERTICAL MILLING ATTACHMENT—Quickly installed . . . Head swivels and locks at any angle in any plane . . . Maximum distance between collet end of spindle and table top: 10¼"—exceptional capacity even for larger mills.

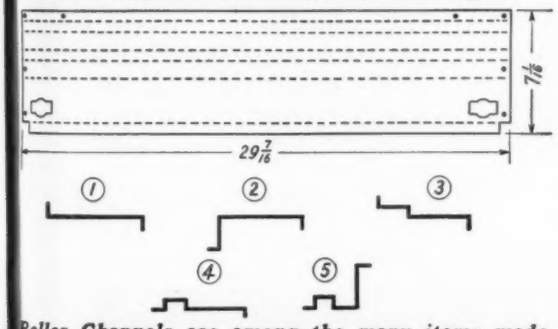
MACHINERY MANUFACTURING COMPANY
1015 EAST 51 ST. VERNON LOS ANGELES CALIFORNIA

Vernon Line of HORIZONTAL MILLS, VERTICAL MILLS and JIG BORERS, SHAPERS and GRINDERS

STEELWELD PRESSES form parts for FROZ-N-FOOD LOCKERS



These lockers are revolutionizing the food industry. Modern locker rooms are kept at zero temperature. They make possible the serving of fresh summer fruits and vegetables on bleak winter days with taste, appearance and quality unchanged.



Roller Channels are among the many items made on the Steelweld Press. These are formed in five steps over V-dies as illustrated above.

Bending and forming parts for drawer slides for Froz-N-Food Lockers on Steelweld Model F-8 Bending Press. Material is 16 gauge pickled cold rolled furniture steel.

For nearly five years the All-Steel-Equip Company, Aurora, Illinois, has been fabricating parts for Froz-N-Food Lockers, shelving and factory and office equipment on a Steelweld Model F-8 Bending Press. Results with this press proved so successful that a year and a half ago another larger press was purchased, a Model H-12.

The All-Steel-Equip Company insists upon accuracy to insure smooth rolling drawers and easy stacking of lockers. All parts must be fabricated within close limits. Duplicate parts cannot vary. Product appearance is also of real importance. Smooth modern lines are desired. These objectives are obtained with the help of their Steelwelds.

If you are working with metal, you owe it to yourself to check into the possibilities of a Steelweld Press. Dozens of varied industries are increasing output, cutting costs, improving quality and aiding product appearance with this modern tool.

CATALOG No. 2002 gives complete construction and engineering details. Mail request for free copy on your company letterhead.

GET THIS BOOK!

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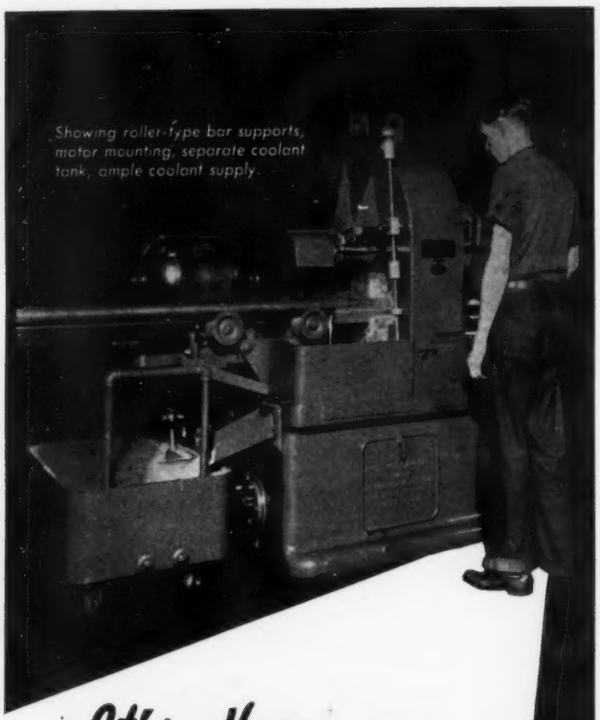
STEELWELD MACHINERY DIVISION
1127 EAST 283RD STREET • WICKLIFFE, OHIO.

MANUFACTURERS OF • CLEVELAND CRANES • CLEVELAND TRAMRAIL • STEELWELD BENDING PRESSES

STEELWELD
BENDING PRESSES

GENERAL SALES AGENTS: CYRIL BATH & CO., E. 70TH & MACHINERY AVE., CLEVELAND



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It is the new **No. 425 CAMPBELL CUTALATOR** *—uses a method that definitely gives you faster production and that handles practically all analyses up to 3½" diameter solid stock and 4½" diameter tubing—annealed or unannealed.*

Micrometer work stop makes for fast set up and accuracy.

Cuts are so clean that you save time and cost of finishing.

You get new cutting speed, freedom from burning, longer wheel life.

Write for a copy of the folder that gives complete details. At the same time, tell us something of your cutting requirements. Our suggestions won't obligate you at all.

ANDREW C. CAMPBELL DIVISION
BRIDGEPORT • CONNECTICUT

Campbell ABRASIVE CUTTING MACHINES

AMERICAN CHAIN & CABLE COMPANY, Inc.
BRIDGEPORT • CONNECTICUT

How to use information on the mechanical properties of materials - - - in machine and structural design

This book brings machine and structural designers a survey of the mechanical properties of engineering materials to aid them in material selection and design procedure. While the technique of testing and test methods are only briefly described, emphasis is placed on the interpretation of test results for design purposes.

Just Out!

MECHANICAL PROPERTIES OF MATERIALS AND DESIGN

By JOSEPH MARIN
Professor of Engineering Mechanics
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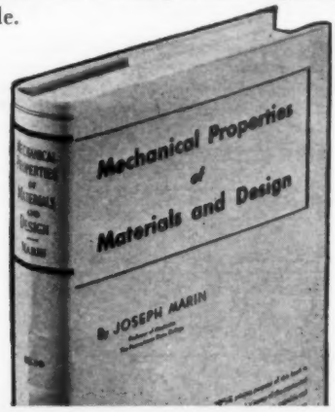
273 pages, 6 x 9, illustrated. $3.50

Interpretation of static, fatigue, impact and creep tests are made for the selection of working stresses. Both simple and combined stresses are considered and the most recent research is discussed in recommending specific theories to be used. The book is illustrated with many specific design charts for particular members and working-stress diagrams are given wherever possible.

This book sent to you for 10 days' examination on approval. Just mail the coupon.



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With effortless speed and precision, H-P-M Fastraverse Presses are working 24 hours a day in the nation's principal aircraft and defense industries. The versatility, high production and smooth "day in" and "day out" performance of H-P-M Presses make them the standard for today's metal working operations. Look to H-P-M for stepped up defense production.

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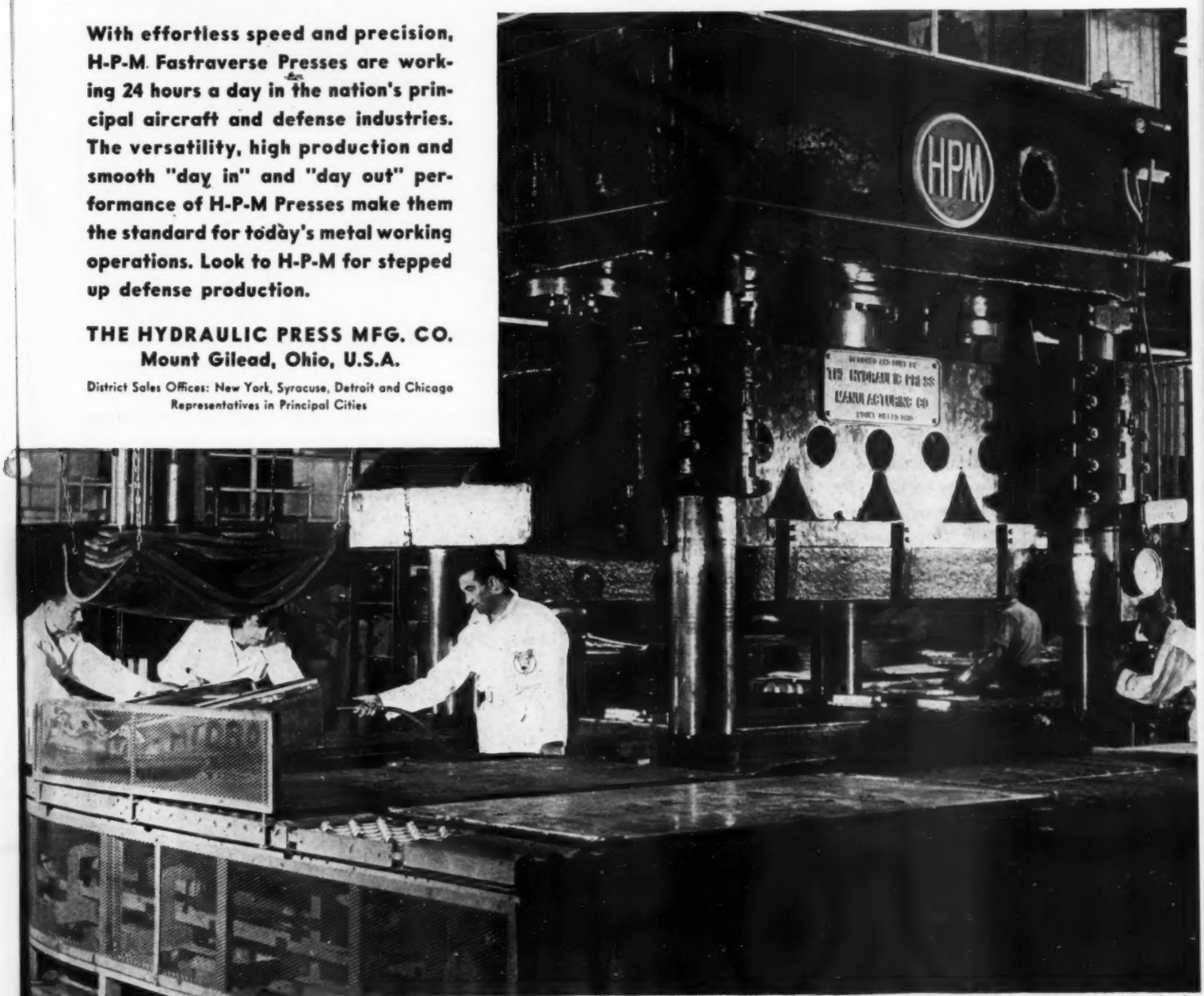


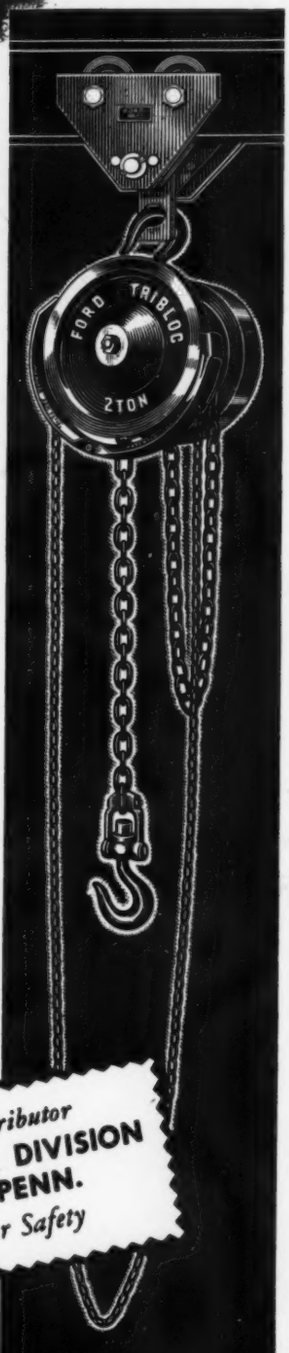
Fig. 5932-A—"Dural" blank 36" x 40" x .051" thick. Female "Kirksite" die on loading table.

Fig. 5932-B—Deep draws like this require additional rubber to help fill die cavity.

Fig. 5932-C—Finished part after pressing. Depth of draw—8"

Ford Triblocs

LOW FIRST COST
LOW MAINTENANCE



FORD TRIBLOCS are not only low in first cost, but they are *extremely* low in maintenance cost. They provide the most economical load transportation—vertical by chain block and horizontal by Ford trolley. **FORD TRIBLOCS** are fast and smooth in operation and they are "on the job," available for use on the instant. They help you maintain production schedules—help you avoid costly delays.

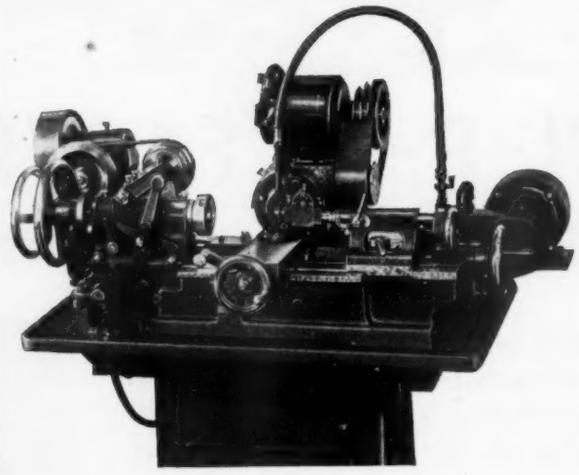
The **FORD TRIBLOC** is a quality spur-gear hoist. It is made throughout of high grade drop forgings and malleable castings of certified grade. Its Acco High Carbon Heat Treated Chain has great strength and high elastic limit. Hoists are tested to a 50% overload before shipment.

Write for information on **TRIBLOCS** in ¼-ton to 40-ton capacities.

Order from your distributor
FORD CHAIN BLOCK DIVISION
PHILADELPHIA, PENN.
In Business for Your Safety

ACCO

AMERICAN CHAIN & CABLE COMPANY, INC.
BRIDGEPORT, CONNECTICUT



WALTHAM THREAD MILLER
WITH 3 MOTOR DRIVE

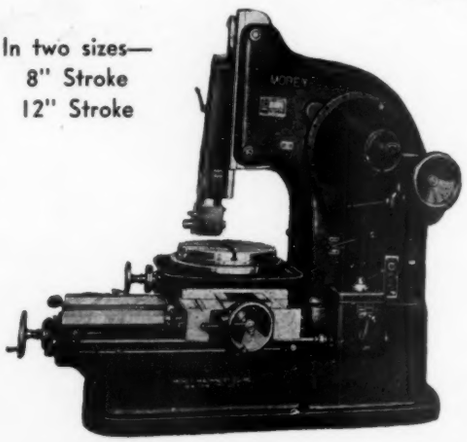
A semi-automatic machine for production or tool room service. It is best adapted for work 2" in diameter or smaller. Special equipment for short multiple cutter work with cam shaft control can be furnished. A cutter head for internal work can also be supplied.

WALTHAM MACHINE WORKS
HIGH STREET **WALTHAM, MASS.**

MOREY

Vertical Shapers

In two sizes—
8" Stroke
12" Stroke



Accurate—simple for toolroom manufacturing.
Self-contained motor drive.

Timken tapered roller bearings for the main spindle—all others anti-friction

Ask for Circular No. 726

MOREY MACHINERY CO., INC.
410 Broome Street **New York, N.Y.**

PEERLESS SAWS CUT *FAST AND STRAIGHT* . . .

As Little as 1/16" Removed by the Cool-Cutting Blade

Yes, whether it's tractors for the farmer or tanks for defense, the conservation of metals is always mighty important.

When metals are SAWED with a straight-cutting Peerless, maximum savings result — as little as 1/16" of material is removed, and there is no danger of surface hardening or fracturing the metal. Even the fine "steel-dust" is easily salvaged from the chip tray where it is neatly stacked by the constant flow of the coolant.

Less metal removed means — LESS CUTTING TIME . . . LESS HAUL-BACK TONNAGE for the railroads and LESS RE-ROLL TIME for the steel mill.

Ask all about PEERLESS — the Saw with the patented Four-Sided Saw-Frame and Backing-Plate Blade Support. A brief note on the coupon will bring a complete recommendation on any of your metal cutting problems.

PEERLESS MACHINE COMPANY, *Racine, Wisconsin*

Performance Report "B"

The Peerless High Duty, Hydraulic Saws with automatic bar feed are cutting 2¼" bars of 4140 molybdenum on vital defense work.* They are averaging four square inches a minute in this extremely tough material.

***Name on request.**

Peerless
METAL SAWING MACHINES

PEERLESS MACHINE COMPANY, Dept. AM-242, Racine, Wisconsin

Mail cutting time estimate for.....

☐ Mail catalog on Hydraulic type Saw for High Production Cutting
☐ Mail catalog covering Vertical type used for Die Block Work
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Company.....

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FAST, ACCURATE CUTTING DEMANDS POSITIVE BLADE CONTROL

McCASKEY TOOL CRIB CONTROL

provides a practical way to obtain . . .

MORE PRODUCTION* WITH LESS TOOLS**

Time for tool crib transaction reduced almost 75%. *The works accountant in a modern plant reports as follows: "Previous to the McCaskey installation, a time study disclosed that a tool crib transaction was completed in 1.24 minutes. Similar time studies reveal that a transaction is completed in 20 seconds in the McCaskey equipped crib." Minutes saved at the crib mean hours gained in production.*

A $2000 Windfall
The general superintendent of a large manufacturing plant writes, "One of the first results of the plan (McCaskey Tool Crib Control) was the turning in of $2000 worth of tools, virtually a windfall, so far as practical use was concerned."

★ NO DELAYS AT THE TOOL CRIB WINDOW

Faster service at the crib window is assured by McCaskey Control. Tools are located instantly whether in the crib or on *the production floor*. Responsibility for tools drawn is quickly and definitely fixed, eliminating time-killing and irritating disputes about tools returned. Numerous other savings of time frequently lost at the crib add up to *more productive hours* for men and machines—to the increased production so essential today.

McCaskey procedure is exceedingly simple. Speedy service is not dependent on memory and it enables even inexperienced attendants to do an effective job—most important now, when experience is at such a great premium. McCaskey Control is proving particularly practical also in handling today's multi-shift operations in hundreds of installations.

★ NO "HOARDING" OF TOOLS NOT IN USE

With McCaskey, tools are kept in circulation preventing their accumulation in employees' tool boxes or around machines. Loss and theft of tools are likewise minimized as well as breakage. Hidden records encourage "hoarding" of tools that should be available for the use of others; the complete visibility of McCaskey prevents it almost automatically. McCaskey dated records tell at a glance how long tools have been out, indicating the ones that should be returned.

This constant check on tool availability, on where and how long they are in use, and other desirable features are enabling hundreds of plants to maintain high production with fewer tools. The danger of production delays from tool shortage is vastly minimized.

A McCaskey representative is available to render valuable assistance in helping you attain more production with less tools. Write for this assistance, *NOW*. No service fee. No obligations.

THE McCASKEY REGISTER COMPANY, ALLIANCE OHIO

McCASKEY INDUSTRIAL CONTROLS

PRODUCTION • INVENTORY • MAINTENANCE • TOOLS • COSTS • PAYROLL

100 LARGE

Thick Metal Stampings

(Die Cut)

Can now be had at a comparative cost of six or eight hand made parts.

We are now in a position to produce large die cut metal stampings any size or shape in small lots requiring a maximum flanking pressure up to 500 tons.

It should be easy to see how this service will save you time and money.

Write for details.

DAYTON ROGERS MANUFACTURING CO.

NEW YORK MINNEAPOLIS, MINN. CHICAGO

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Advertisements on this and the following page are placed here by well-known concerns doing work on a contract basis. When you need assistance write to these established manufacturers.

FORGINGS

LIGHT WEIGHT INTRICATE WORK

Aluminum	—Maximum Weight—4 lbs.
Brass or Copper	—Maximum Weight—15 lbs.
Steel	—Maximum Weight—1 lb.

Smooth forgings only or machined complete to your specifications.

LINCOLN FORGING CO. 622 ST. ANTOINE STREET DETROIT . . . MICHIGAN

STAMPINGS AND ASSEMBLIES

Fast Service on Long or Short Runs

"GREATER SAVINGS WITH GREIST"

We can handle your stamping and assembly requirements in any metal. Our modern equipment and methods coupled with 50 years of experience is your guarantee of accuracy and efficiency. Our facilities include capacity for handling screw machine products, tools, dies, jigs and fixtures.

Quality work by skilled mechanics is assured. Send your blueprints or samples today for prompt quotations!

THE GREIST MFG. CO.
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METAL STAMPINGS

• TOOLS • DIES •

PERMANENT MAGNETS

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THOMAS & SKINNER STEEL PRODUCTS CO.
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We can build machines and parts, special tools and fixtures of all kinds to your specifications and design. Skilled workmen and modern equipment are your guarantee of satisfaction. The design and building of wire and ribbon stock forming machines are our specialty.

We solicit your blueprints or samples for quotation. No obligation of course.

THE A. H. NILSON MACHINE COMPANY
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Need steel balls for defense assemblies ?

The Abbott Ball Company
1042 New Britain Ave., Hartford, Conn.
ABBOTT BEARING BALLS

Our Grey Iron Foundry, Structural and Machine Shops are at your disposal

for

Medium Heavy
SPECIAL MACHINERY
CONTRACT WORK SOLICITED

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YOU CAN GET SUB-CONTRACTS NOW!

Advertising in American Machinist's CONTRACT WORK SECTION is your most efficient and economical means of putting your idle capacity to work. For details, write

CONTRACT WORK DEPARTMENT
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DEFENSE SUB-CONTRACTS WANTED

Precision tool manufacturer has available capacity for small spur and helical gear-cutting, diamond boring and small mill work in defense production. This is a well equipped Chicago plant with an established reputation for the quality of its work.

Address Box 183

WIRE AND METAL SPECIALTIES
In round, flat, square and special shaped wire in all metals.

LARGE PRODUCTION CAPACITY
Plating and finishing.

EASTERN TOOL & MFG. CO.
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SUB-CONTRACT FACILITIES FOR

Non-ferrous hand screw machine products.

Engine and bench lathe, milling and drill press work.

Small sheet metal fabrications to closer than commercial tolerances.

Stampings.

We do our own tooling.

RELIANCE MACHINE & MFG. CO.
Thirty Irving Place — New York City
36 years experience in metal fabrication.

• DRILLING • TAPPING
• ASSEMBLY WORK
• LIGHT METAL STAMPINGS

Our experience and modern equipment are your guarantee of satisfaction. Send us your blueprints or samples for prompt quotation.

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JIGS, FIXTURES & GAGES
REED MACHINE & TOOL ENG.
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PATTERNS in WOOD and METAL
For All Kinds of Castings, Large or Small
MATCH PLATE WORK A SPECIALTY
Put your pattern problems up to us—we will take care of them—ask the foundries about our work—they use our patterns every day.

GENERAL PATTERN WORKS
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LET US HANDLE YOUR SUB-CONTRACT WORK

THESE MACHINES ARE READY TO WORK FOR YOU!

We have considerable production hours available for the machines listed in this advertisement. In addition we have bench and assembling facilities. We are accustomed to the manufacture of precision products. *Check the list* . . . if you find units that can handle some of your overflow work, write, wire or phone us at once.

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1 #2A B & S
7 #0 B & S
1 #1A Milwaukee
1 #2A B & S
2 #2B B & S
1 #2 Owen

DUPLEX MILLERS
1 #2 Garvin
1 #1½ Garvin
1 #1 Garvin
1 W. B. Knight 32"
1 24" Cincinnati Automatic
1 24" Cincinnati Hydromatic

HAND MILLERS
1 #4 Burke
3 U. S. Milling Machine Co.
1 Chicago
1 Carte & Habes
1 #5 Burke

PUNCH PRESSES
1 #3 R & K
1 #3 A. Willard
1 #1 Elkhardt
1 #2 L & J Back Gear Type

DRILL PRESSES
Single Spindle
3 H & W
1 H & R
1 18" Pearlee
2 17" Delta
1 #1284 Delta 17"
1 20" Power Feed Walker Turner
3 #3—3 spindle H & W
1 14"—2 spindle Delta

HEAVY DUTY
1 3' Morris Radial
1 #5 Fosdick

LATHES
1 20" x 10' LeBlond
1 36½" x 14' Bradford
1 10" x 10' Champion
1 14" x 6' Cisco
1 16" x 7½' LeBlond

SHAPERS
1 12" Smith & Mills
1 16" Smith & Mills
1 24" Cinti. Heavy Duty

SCREW MACHINES
1 #2 B & S Turret Lathe
2 #0 B & S Full Automatic
1 #2 B & S Full Automatic

MISCELLANEOUS OTHER MACHINERY
1 #00 Baker Key Seater
1 32" x 6' Cincinnati Planer
1 Abrasive Cut-Off Machine
1 10" x 24" Landis Universal Grinder

THE PRINTING MACHINERY COMPANY
436 COMMERCIAL SQUARE — CINCINNATI, OHIO

WANTED

FOUNDRY WORK

FOR CAST IRON FOUNDRY

We want work for our cast iron foundry in Pottsville, Pa. As an illustration of capacity, one day this week we cast a 30,000 lb. bed-plate for one of our greatest turbine manufacturers; a low pressure cylinder for a reciprocating job, weighing approximately 40,000 lb.; water boxes, covers and bonnets for steam condensers as well as other miscellaneous items.
Immediate capacity available for special castings or castings required in volume.

Condenser Service & Engineering Co., Inc.
310 Twelfth Street — Hoboken, New Jersey
Phones: Rector 2-9360—Hoboken 3-4425

SUB-CONTRACTING SOLICITED

Modern 4 story factory with 100,000 sq. ft.

- **Medium and light stampings and units using such.**
- **Thermoplastic moldings up to 8 oz.**
- **Plating, all types, polishing, lacquering, spraying, baking, enameling.**
- **Large available space for sub-assemblies.**
- **Maintenance tool room with lathes, miller, drills, etc.**
- **Spot welding up to 10 KVA and assemblies.**
- **Special shapes of wire and channels, etc.**

ARCO METALCRAFT, INC.
480 E. 144th St. — Bronx, New York City

KIRK & BLUM

WELDED MACHINE BASES, PEDESTALS and FRAMES
LATHE PANS
GEAR and BELT GUARDS
Pressed Steel Louver Panels and Cover Plates

THE KIRK & BLUM MFG. CO.
2823 Spring Grove Ave., Cincinnati, Ohio

WANTED

SUBCONTRACT WORK

for

ENGINE AND TURRET LATHES

We can do rough or finished machine work on these machines to your specifications and are equipped to handle sub-assembling. Write or wire for full description of available facilities.

EDWARDS MFG. CO.
VOORHEESVILLE — NEW YORK

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Why your Red Cross urgently needs

FIFTY MILLION DOLLARS, NOW

How the fund is allocated . . . What it does in service

Every dollar that you give now to your Red Cross marches into the thick of things where humanitarian help is needed most—up to the fronts and battle stations where the fighting is heaviest. Into the Red Cross hospitals and First Aid units where prompt medical attention and supplies may save innumerable lives. And throughout our broad land to train and equip volunteers to meet any emergency that may strike.

How the $50,000,000 War Fund is Used

SERVICE TO THE ARMED FORCES • • • • • • $25,000,000

Provides for the care, welfare and morale of the Army and Navy, including services to men in hospitals and during convalescence. • Provides an important link between the service men and their families; keeps the families from breaking up, supplies food, shelter, medicine, and even jobs where necessary. • Provides essential medical and other supplies outside of standard Government equipment. • Operates Red Cross headquarters at camps and naval stations. • Enrolls blood donors and medical technologists for Army and Navy needs. • Provides millions of surgical dressings, sweaters, socks, etc. through volunteer workers.

DISASTER AND CIVILIAN EMERGENCY RELIEF • $10,000,000

Supplies emergency needs for food, clothing, shelter and medical attention for disaster victims. • Assists stricken families in repair of homes and other adjustments; provides minimum reserves of essential relief supplies to prevent unnecessary delays.

CIVILIAN DEFENSE SERVICES • • • • • • • • $ 5,000,000

Trains volunteers for home nursing and nurses' aides. • Trains nurses, men and women, for active duty with the Army and Navy. • Trains volunteers in First Aid and accident prevention. • Trains volunteers for work in Motor Corps, Canteen and Production. • Instructs men, women and children in preparedness against explosive and incendiary bombs. • Organizes for evacuation of children and their families from stricken areas. • Assists Red Cross Chapters in establishing effective coordination of emergency relief with local and State defense authorities.

SERVICE AND ASSISTANCE THROUGH CHAPTERS • $ 4,000,000

Gives assistance and service to the 3,740 Red Cross Chapters with their 6,131 Branches responsible for local Red Cross activities, particularly welfare work among the service men and their families.

OTHER ACTIVITIES AND CONTINGENCIES • • • $ 6,000,000

Provides for unforeseen expansions in program and for new activities made necessary by unexpected developments.

TOTAL • • • • • • • • • • • • • • • • • $50,000,000

THE AMERICAN RED CROSS $50,000,000 WAR FUND

Note to Red Cross Canvassers: Use the material on this page to better inform contributors how their donations are being expended.

This space contributed to The American Red Cross by AMERICAN MACHINIST

POSITIONS VACANT

HIGH SPEED STEEL METALLURGIST to take charge of heat treating department of rapidly expanding small tool manufacturer. Steady business now employing about 300 offers exceptional opportunities. Metallurgist must be capable at directing research work in hardening small high speed tools. Age preferred 25-35. Starting salary $4000.00 and bonus. Location Middle West. P-165, American Machinist, 520 N. Michigan Ave., Chicago, Ill.

MECHANICAL ENGINEERING GRADUATE wanted, with 2 to 5 years experience in design, development or production, to do design and development work on firearms. P-177, American Machinist, 330 W. 42nd St., New York, N. Y.

MACHINIST: Automatic turret setup man to take charge of three six-spindle Bairds. Job pays top rates. Peacetime opportunity for right man. Philadelphia concern. P-185, American Machinist, 330 W. 42nd St., New York, N. Y.

SUPERINTENDENT AND INSPECTOR. A metal cutting tool plant making milling cutters, form cutters and special metal cutting tools, employing approximately 100 productive men is in the need of a superintendent and an A-1 inspector. Both must be well versed in the manufacture of such tools. A wonderful opportunity for the right men in a live growing concern in Detroit, Michigan. Give references, salary wanted and years of experience in first letter, which will be held strictly confidential. P-187, American Machinist, 520 N. Michigan Ave., Chicago, Ill.

MACHINE DESIGNER: Position open for first-class machine designer of proven ability, experienced in the design of modern machine tools. This position is steady for the right man. Applicants must be citizens of the United States. Location: Rhode Island. P-188, American Machinist, 330 W. 42nd St., New York, N. Y.

DRAFTSMAN—Capable of assisting chief Engineer in the Production of gasoline and diesel engines under 20 H.P. Give age, experience and photo first letter. Witte Engine Works, Kansas City, Missouri.

POSITIONS WANTED

(See also "Selling Opportunity Wanted")

MECHANICAL ENGINEER, Processing, tool design, and tool making production control. Shells, Artillery, instruments. PW-170, American Machinist, 330 W. 42nd St., New York, N. Y.

FACTORY MANAGER or Factory Superintendent. Practical Tool and Die Eng. with twenty-five years experience as Tool Supervisor, Chief Inspector, Assembly Superintendent, Factory Superintendent and Assistant Works Manager. Manufacturing medium and small sized intricate mechanism. Modern Methods. Successful Record. Desires change to defense work. PW-176, American Machinist, 330 W. 42nd St., New York, N. Y.

ENGINEER of executive caliber—Versatile and with initiative, desires responsible position with progressive manufacturer. Trained metallurgical engineer, Ph.D., naturalized U. S. citizen, 38, Christian, married. Nine years with leading U. S. metal producer in research, development, production, engineering selling. Three years N. Y. manager of foreign trade corporation—import, export, marketing, advertising, technical writing. At present Industrial Consultant with office in NYC and Technical Advisor to machine manufacturer. PW-189, American Machinist, 330 W. 42nd St., New York N. Y.

ENGINEERING DEPARTMENT group supervisor experienced on drafting, checking, designing, statistics, and charts desires position where this experience would be of value. PW-186, American Machinist, 520 N. Michigan Ave., Chicago, Ill.

PROFESSIONAL SERVICES

Machine Tool Designing Engineers

30 Years Experience in Designing Building & Developing Production Machinery & Processing Operations

Automotive — Tractor
Airplane — Munitions

1115 E. 35 St., Indianapolis, Indiana

W. K. Millholland Machinery Co.

OPPORTUNITY WANTED

NEW YORK REPRESENTATIVE—acquainted in Government Procurement Offices—can handle Victory contract and subcontract sales for responsible machine shop working turret lathes and supporting equipment. RA-182, American Machinist, 330 W. 42nd St., New York, N. Y.

CONTRACT WORK

WORK WANTED — For advertisements of work wanted see names indexed under Contract Work in the Searchlight Section Index appearing on the page Facing the inside back cover.

PATENT ATTORNEY

PATENTS—Booklet free. Highest references. Best results. Watson E. Coleman, Patent Lawyer, 724 Ninth Street, Washington, D. C.

PATENTS, COPYRIGHTS. Booklet. "General Information Concerning Inventions and Patents" and "Fee Schedule" sent without obligation. Established 1915. Lancaster, Allwine & Rommel, Suite 453, 815-15th St., N.W., Washington, D. C.

AFTER-THE-WAR PRODUCTS WANTED NOW

Machinery to manufacture for new processes or unusual products having exceptional marketing possibilities. Assistance such as research, engineering, etc., might be furnished to develop the product or machinery now. Our client has retained us to investigate and recommend propositions. It is a PROGRESSIVE COMPANY, having highest financial rating and a modern plant. It is all out to win the war. It wants and will make an all out effort to keep its present organization and employees after Democracy is safe. Propositions submitted will be considered confidential.

BARKLEY ASSOCIATES
528 Commonwealth Ave. Boston, Mass.

NEW INVENTIONS WANTED

Mechanical and electrical devices which can be used to promote our war production program. Either new ideas, or improvements upon present methods.

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Wanted
BOARD DROP HAMMERS,
Various sizes in perfect condition.

W-184, American Machinist
330 W. 42nd St., New York City

Domestic
EMERY DUST
UNGRADED

About 70 tons on hand. Packed in 100-lb. bags.
Reasonably priced—F.O.B. Peekskill, N. Y.

WALTER MAGUIRE CO., INC.
330 W. 42nd St., N. Y. C.

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62" Coburn, Vertical, power rapid traverse, 2-swivel heads on crossrail, self-contained single pulley drive. Rebuilt.

62" Bullard, Vertical, 2-swivel heads on crossrail, with self-contained single pulley drive. Good condition. Both machines have gear feeds.

Can demonstrate—Immediate delivery

GALBREATH MACHINERY COMPANY
306 Empire Building Pittsburgh, Pa.

FOR IMMEDIATE DELIVERY:

Ridgeway Planer: 74" x 74" x 32'
Universal Milling Machine: No. 1½ Cincinnati
Universal Milling Machine: No. 2 Cincinnati
Universal Milling Machine: No. 4 Cincinnati
Milling Machine: No. 4 Becker Vertical
Turret Lathes: No. 2 Warner & Swasey (3)
Turret Lathe: No. 3 Warner & Swasey
Turret Lathe: No. 6 Warner & Swasey
Turret Lathe: No. 4 Gibbs
Lathe: 18" x 8' Monarch, Q.C., back geared
Lathe: 16" x 6' Hendey, Q.C., yoke head
Lathe: 16" x 10' Whitcomb Blaisdell, Q.C.
Engine Lathe: 12" x 6' W. C. Young, B.G., Q.C.
Radial Drill: 4' Universal.
Press: Power, Bliss No. 0, Stiles, C.B.
Press: Power, Bliss No. 4, Stiles, C.B.
Shapers: 24", 20", 16", G. & E.
Shaper: 20" Steptoe.
Cy. Grinders: No. 3 Modern Universal (8)
Universal Grinder: No. 2 Bath.

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ST. LOUIS' Headquarters FOR GOOD USED TOOLS, OFFERS:

GOULD & EBERHARDT 24", S.P. Shaper
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BARNES 4-S.P. Grd. Camel Back Drill
HENDEY 16"x8' Q.C.G. Lathe
CINCINNATI # 1-M S.P.D. Pl. Miller
NEWTON Vert. Miller 47" Rot. Table
INGERSOLL M.D. Slab Miller
B&S 48"x10" #4 Gear Cutter
FELLOWS #3 Gear Shaper

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Let Us Quote On All Machinery Needs

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1531-35 N. Broadway St. Louis, Mo.

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2¼ and 3¼ Gridley automatics
96" x 20' Putnam geared face plate driven lathe
42" Bullard vertical boring mill, M. D.
44" Rogers vertical boring mill
62" vertical boring mill
16" x 10' Hendey M. D. lathe
16" x 54" Norton grinder
16" x 66" Landis universal grinder
5' Fosdick radial drill

Carry a large & selective stock of machinery. Kindly send your inquiries

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Milling Machines, Planers, Shapers, Power, Drill and Foot Presses. Lathes, Punches, Cutters, Belting-Transmissions.

Entire Plants bought and sold

ADVANCE MACHINERY EXCHANGE, INC.
182 Centre St., New York, N. Y.

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YOUR REQUIREMENTS FOR

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MACHINE TOOLS

Lathes, Milling Machines — Planers, Shapers — Grinders, Radial Drills — Drill Presses, Punch Presses — Slotters, Gear Cutters

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14"x 6' Rockford
14"x 8' American
16"x 8' Hodge & Shipley
18"x10' Mueller
26"x10' LeBlond, Universal Crankshaft

MILLING MACHINES

Standard Hand Millers, M.D. (2)
2" Pratt & Whitney spline (duplex) (Double)
No. 2 Brown & Sharpe, Vertical

BORING MILLS

51" Bullard, Vertical, 2 Heads

TURRET LATHES

Goss & De Leeuw Chucking, 6"x6½"
2 Spindle J&L Steel Head
3¼"x36" Acme flat Turret

GEAR MACHINERY

No. 65 Fellows Gear Shaper
No. 61 Fellows Gear Shaper, M.D.
No. 712 Fellows Gear Shaper, M.D. (2)
No. 4—48" Brown & Sharpe Gear Cutter
Lees Bradner Gear Grinders (2)

MISCELLANEOUS

No. 1 Foste-Burt Duplex Surface Broach
8" Weiland Standard Pipe Machine
No. 4 Hilles & Jones Double End Punch and Shear
2" Acme Bolt Threader
7' Dreses Radial 17" Column
No. B-16 Natco Multiple Spindle Drill
No. 1 Baker Keyseater
No. 27 Beloit Splitting Shear

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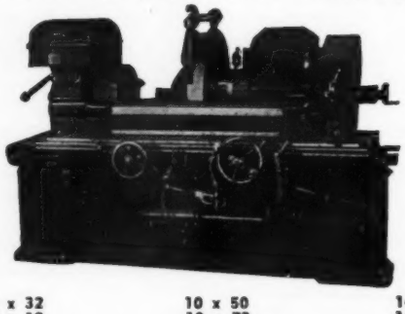

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6 x 32	10 x 50	14 x 72
10 x 18	10 x 72	14 x 96
10 x 24	10-15 GAP x 72	16 x 50
10-15 GAP x 24	14 x 36	16 x 72
10 x 36	14 x 50	18 x 96

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#5-N NAZEL, arr. M.D.—capacity 6" square.
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McCabe ½" Flangers
Pels No. 23 Triple Combination Punch
Pels 6' Throat Punch
Cleveland 30" Turret Punch
8', 10' D. & K. Power Leaf Brakes.

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AUTOMATICS, Acme #56—2¼" 4 spdle.
AUTOMATICS, Cleveland 4½" Model M Chucker
AUTOMATICS, Cleveland, 3¼" Model A, M.D.
AUTOMATICS, Gridley, 2¼, 3¼ & 4¼" S.S.
BORING MILLS, Bullard, 42" 2 Swivel Heads
BORING MILLS, Niles, 54" 2 Swivel Hds.
GRINDERS, B.&S. #2 & 3 Universal
GRINDERS, Landis, 10x36" Self Contained
GRINDERS, Landis, 16x72" Plain
GRINDERS, Norton, 10x24 & 36" Plain
LAPPER, Norton #15 Vertical, M.D.
MILLING MACHINES, Becker Vertical, #4B. Model B1—M.D. & C5.
PLANERS, 30x30x8' Ctl-44x44x18' Niles
PRESSES, Toledo, #34 Solid Back, S. G.
PRESSES, Ferracute, P2, 3 & 4, Solid Back.

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542 Second Ave. Detroit, Mich.

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7—DUPLEX ROTARY CONVERTERS, G. E., (Identical) 1500 KW—750 KW, 500 RPM, 13,200 V., 3 phase, 25 cycle, to 1300—650 volt direct current. Complete with Transformers, Reactances, Switch Gear and Controls.

Motors - Sheet Steel Piling - Hoists
Cranes - Misc. Items

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1—#12 Barber-Colman Gear Hobber, M.D.
1—#3 American Broach Machine
1—#3 Lodge & Shipley Duomatic Lathe
1—18" Libbey Turret Lathe
4—8" Sundstrand Stub Lathes
1—No. 17 Barber-Colman Gear Hobber
1—#2 Leland Gifford Single Spindle Drill Press
2—15" Gleason Pinion Roughers
2—#6 Bryant Chucking Machines
1—#13 Pratt & Whitney Multiple Drill, M.D.
1—Norton Type B Model 81 Crankpin-Grinder

Your inquiries receive prompt attention

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122-126 Nebraska Ave., Toledo, O.
Adams 1914

IN STOCK

These machines are in our warehouse as this goes to press. They are ready for immediate delivery in good running order, or can be rebuilt to your requirements.

READY FOR YOUR PRODUCTION LINE!

AUTOMATICS
3¼" Gridley Single Spindle
#73 Prentice Chucking, 8 stations

BORING MILLS
36" B&S Turret, chucking
3¾" Bar Bement horizontal
5" Bar Niles floor type

DRILLS
One Spindle Allen B. B.
One Spindle Avey B. B.
One Spindle H&W B. B.
Two Spindle Rockford
Two Spindle Prentice
Four Spindle Allen, B. B.
Four Spindle Rockford
Bickford Rail Drill
Four Spindle Foote-Burt #4
No. 39 Natco Str. line
No. 30 Baush Rect. Head
No. 12 P&W Rect. Head
No. 15 Baush 2½" spindles
No. 25 Foote-Burt heavy
No. 1SS Garvin Duplex

GRINDERS
No. 1 Wilmarth Morman Univ.
No. 1 Cincinnati T. & C.
24" Ingersoll face mill
No. 1 Bridgeport D. C. motor
No. 6 Webster Perks polishing
8"x18" Modern, plain
6"x32" Norton, plain
8"x36" B&S No. 12
16"x50" Norton, plain
No. 60 Heald
14" P&W Surface
22" P&W Surface
53" Besley Disc
12" Besley Disc
18" Besley Disc
22" Besley Disc
24" Besley Disc
16" Gardner Ring Wheel
18" Gardner, sizing
18" Besley, sizing
36"x76" Farrell Roll

GEAR CUTTERS
24"x8" B&S Spur
24"x9" G&E Spur
36"x10" B&S Spur
50"x8" G&E Spur and bevel
60"x12" B&S Spur
60"x16" G&E Spur and bevel
64"x20" G&E Spur
90" P&W spur and worm
24" Adams Hobber
5A Lees-Bradner Generator
6" Bilgrim Generator
16" Bilgrim Generator

LATHES
18"x16' N. B. P. MD
18/44x8' Putnam Gap
19/38"x10' LeBlond Gap
21"x10' LeBlond Q. C. G.
24"x10' Lodge Shipley
24"x18' Boye Emmes
30"x12' Lodge Shipley, selective
30"x15' Lodge Shipley
32"x14' Pond, G. H.
36"x20' Pond, cone
48"x16' Bement, cone
60"x20' Niles cone raised to swing 84"
32"x21' N. B. P. heavy turning
48" Tindell, Crankshaft
20' Gleason Pit
13"x8' Automatic threading

MILLERS (Planer Type)
18"x105" P&W Duplex
24"x30"x10' Ingersoll, Vert. Spl.
30"x30"x10' Newton, Horiz. Spl.
48"x30"x14' NBP Horiz. Spl.
4" P& W Spline
66"x60"x15' Ingersoll, Planer
2M Potter Johnson Automatic

PLANERS
24"x24"x6' Pond, 1 head
36"x36"x10' Pond, MD
36"x36"x10' D&H Openside
54"x54"x12' NBP, 4 heads
52"x52"x10' Cincinnati, 2 heads
60"x48"x12' Cincinnati, 2 heads
84"x32"x42' Southwark, Ex. Heavy, 4 heads, Rev. M. D. P. R. T.
36" Newton Rotary, M. D.
42" Newton Rotary, M. D.
60" N. B. P. Rotary, M. D.

RADIALS
30" Bickfford Plain
30" H&W Sensitive
36" Carlton Sensitive
4' Hammond Sensitive
4' Bickford, gear box
4' Morris, gear box
5' Western, low hung
6' Baush, Ex. heavy

PRESSES, PUNCHES-SHEARS
No. 16 Bliss Trimming
No. 01S V&O Bench
No. 77 Bliss, geared
10-ton H&W Dieing
400-ton NBP Wheel
20" throat H&J Punch
12" throat H&J Punch
24" throat EF Cleveland
48" H&J Punch
60" throat Long Alstatter
20" EF Cleveland Dbl. end
RT40 Naumann, beam
No. 1 Buffalo Universal

COLD SAWS
7" cap. No. 5 Cochrane Bly
7" cap. Newton M.D.
9" cap. Newton, pneumatic clamp
12" cap. Newton No. 574
24" cap. Ryerson Friction D. C.
4" cap. Campbell 302 Abrasive
Radiac Abrasive Saw, 3HP motor

SLOTTERS
3" Pilton, belt drive
12" New Haven
12" Sellers
14" Scott, heavy
15" N. B. P. motor drive
20" Sellers motor drive
22" N. B. P. belt or motor
30" Baker, draw stroke
60" Newton, portable

TURRET LATHES
18" W&S fox type
24" W&S fox type
1½"x18" P&W
2¼"x26" Greenlee
4½"x30" B&O
Millholland Staybolt Machine

R. R. SHOP TOOLS
48" Putnam Car Wheel Boring
52" Betts Car Wheel Boring
No. 2 NBP Axle Lathe
No. 4 Putnam Axle Lathe
No. 3 NBP Axle Lathe
Bridgeford Journal Truing
42" NBP Wheel Lathe
42" Putnam Wheel Lathe
48" NBP Wheel Lathe
85" Putnam Wheel Lathe
Newton Axle Keyseat Mill
1½" Acme double bolt threader
2" Landis, double bolt threader

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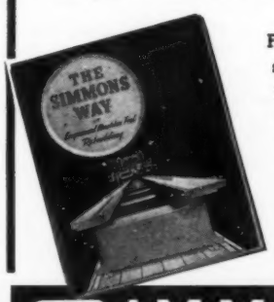

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Write for a rebuilding estimate on YOUR tools.

SIMMONS ENGINEERED *Machine Tool* REBUILDING

SIMMONS MACHINE TOOL CORP.
1759 NORTH BROADWAY, ALBANY, N. Y.
New York Office: 149 Broadway

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No. 12 Bryant Internal, 2 m.d.
No. 10 Bryant Internal, belt
No. 1 Warren F. Fraser Lapper, belt
18x48" Diamond L.D. Face, m.d.
30x84" Diamond H.D. Face, m.d.
54" Bridgeport Knife, belt
Covell-Hanchett Knife, m.d.
No. 3—12x42" Landis Universal, belt
12x48" Modern Universal, belt
No. 4 Brown & Sharpe Universal, belt
6x32" Norton Plain Cylindrical, m.d.
10x18" Brown & Sharpe Plain, m.d.
10x24" Land's Plain, m.d.
10x30" Queen City, Plain, m.d.
10x36" Land's Integral Cam, m.d.
10x36" Norton, m.d. (6 in stock)
10x50" Norton, m.d.
10x52" Landis, m.d.
12x18" Cincinnati Plunge Cut, m.d.
12x36" Cincinnati Plain, belt
12x36" Cincinnati Plain, m.d.
12x36" Modern, m.d.
12x42" Landis, belt
12x48" Modern, m.d.
12x72" Cincinnati Plain, m.d., hydraulic feed
16x52" Landis Plain, m.d.
18x72" Cincinnati Automotive Parts, m.d.
Cincinnati Valve Seat Grinder, m.d.
No. 4 Gardner Disc, belt
No. 6 Diamond Disc, belt
No. 20 Gardner B.B. Combination Disc and Roll Sander
No. 120 Gardner Plain Double Disc
No. 120 Gardner Combination Disc
No. 3 Brown & Sharpe Universal Cutter & Reamer
No. 4, 5, 31 Oliver Drill Pointers, m.d. in base
No. 23 Brown & Sharpe Gear Cutter Grinder
Gisholt Universal Tool Grinder, belt
Gleason Cutter Grinder, belt
Gould & Eberhardt Gear Cutter Grinder
Landis Chaser Grinder
Modern Chaser Grinder
Yankee Drill Grinder, 1½" cap.

SLOTTERS

84" Vertical Slotter, m.d.

RADIAL DRILLS

2½' Avey Sensitive, belt
3' American Sensitive, belt
3' Carlton Sensitive, belt
3' Mueller Plain, gear box
4' Hammond Jack Knife, m.d.
4', 5', 6' Niles-Bement-Pond Semi-Universal, gear box
4', 5', 6' Niles-Bement-Pond Semi-Universal, var. speed m.d.
4', 5' Prentice Plain, cone
4' Ryerson Plain, gear box
6' Dreses Plain, gear box
7' Dreses Plain, gear box
7' Fosdick Plain, cone
No. 1 W. F. & John Barnes Horizontal, cone

GEAR MACHINERY

Gleason Spiral Bevel Gear Rougher, s.p.d.
6", 18" Gleason Straight Bevel Gear Generators, belt
16" Gould & Eberhardt Gear Cutter, belt
D. E. Whiton No. 1 Full Universal Spur & Bevel, belt
No. 3-26" Cincinnati Spur Gear Cutters
No. 3-26", 3-36", 3 Heavy, 4-36", 4-48", 6-60", 6-72" Brown & Sharpe Gear Cutters
No. 5A Lees-Bradner Gear Generator
Cross Gear Tooth Rounder, belt
20" Rochester Gear Tooth Rounder, belt

PLANERS

24"x24"x5' Grav, 1 head
24"x24"x12' Chandler, 2 heads
36"x36"x10' Whitcomb-Blaisdell, 2 heads
36"x36"x13' Niles-Bement-Pond, 1 rail, 1 side head
36"x36"x10' Cincinnati, 2 rail, 1 side head
42"x42"x12' Niles-Bement-Pond, 2 heads
42"x42"x18' Cincinnati, 2 heads

TURRET LATHES

No. 0 Brown & Sharpe Hand, cone
No. 4 Bardons & Oliver, cone
No. 4 Foster, cone
No. 6 Brown & Sharpe Hand, cone
2¼" Acme Flat Turret, cone
2¼x24" Jones & Lamson Geared Head, bar
3x36" Jones & Lamson Geared Head, bar
3x36" Jones & Lamson Geared Head, chucking
2 spindle 3x36" Jones & Lamson Geared Head, chucking
3½x40" Greenlee Flat Turret, cone
16" Warner & Swasey Turret, cone
18" Acme Turret, cone
21", 24" Gisholt, m.d.

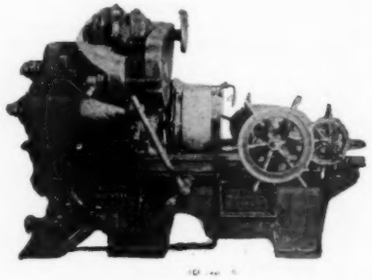
Partial Listing only. Send us your inquiries.

The
EASTERN
MACHINERY CO.
1004 TENNESSEE AVE.
CINCINNATI, OHIO

Pipe and Bolt Machinery

BOLT MACHINERY

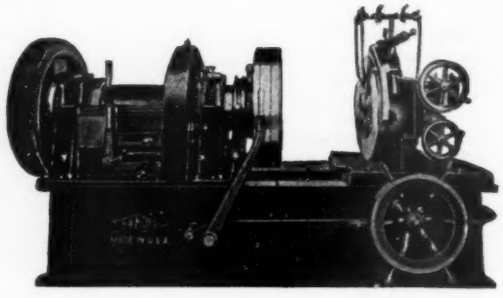
2—4" Landis Bolt Cutters, arranged for silent chain motor drive, with quick change gears
3—2" Landis Bolt Cutters, arranged for motor drive, two with Quick Change Gears
1—2" Landis Double Head Bolt Cutter, with lead screw and arranged for motor drive
1—1½" Landis Double Head Bolt Cutter, arranged for motor drive
1—1¼" Acme Double Head Bolt Cutter, arranged for motor drive with lead screws
1—1½" Geometric, with motor
2—1½" Landis Bolt Cutters, one equipped with motor, one arranged for motor drive
1—1¼" Landis Bolt Cutter, arranged for motor drive
1—1" Acme Bolt Cutter, with motor and lead screw
1—Standard Double Head Bolt Cutter, ¼" to 1", arranged for motor drive
1—1" Landis Bolt Cutter, with lead screw and arranged for motor drive
1—No. 2 Kent 2-spindle Bolt Cutter, with motor
1—No. 2 National Acme Bolt Cutter, arranged for motor drive, with lead screw



11—¾" Geometric Bolt Cutters, with quick change gears, arranged for motor drive
3—Economy Automatic Threaders, 0" to ⅜" capacity, with hopper feed
1—No. 1 Kent 2-spindle Pointer, with motor
1—Cook Screw Pointer, arranged for motor drive
1—No. 2 Waterbury Bolt Trimmer, arranged for motor drive.
1—Model B Lassiter Staybolt Machine, arranged for motor drive
1—No. 1 Garvin Screw Slotter, arranged for motor drive

PIPE MACHINERY

1—No. 5 Williams Threader, 12" capacity, arranged for motor drive.
1—8" Stoever Threader, arranged for silent chain motor drive
1—8" Landis Pipe Threader, with motor and quick change gears
1—4" Stoever Threader, arranged for motor drive
1—3" Stoever Cutoff, arranged for motor drive
1—2" Bignall & Keeler Threader, arranged for motor drive
1—2" Oster Threader arranged for motor drive
1—No. 100 Nye Pipe Threader ¼"-2" capacity, with motor
1—No. 6 Stoever Pipe Threader, arranged for motor drive



1—No. 52 Lovekin Pipe Expander, arranged for motor drive
2—Continental Rotary Pipe Cutoff, arranged for motor drive

Available For Immediate Delivery

LOUIS E. EMERMAN & CO.

1761 Elston Ave. **Chicago, Ill.**

IN STOCK — FOR SHIPMENT

30 Milling Machines

Shapers **Lathes**
Drill Presses **Planers**
Hack Saws **Surface Grinders**
Arbor Presses—all sizes
Universal & Cutter Grinders

All our own rebuilding—fully guaranteed

J. NUTTALL

Established 52 years—same family

1748 N. 5th St. Philadelphia, Pa.
ORGANIZED TO HANDLE EXPORT ORDERS

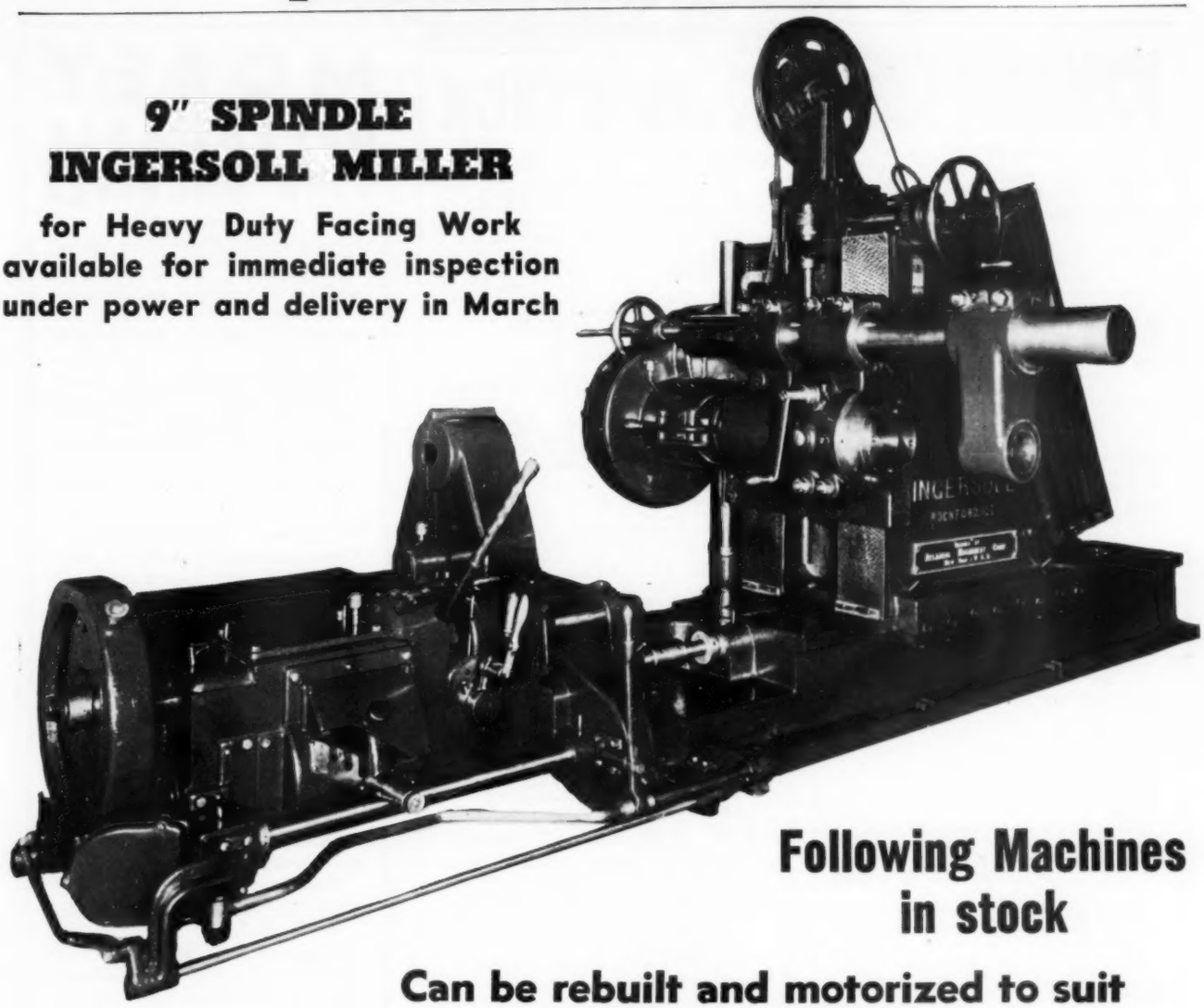
500# B & S Board Drop Hammer.
800# B & S Board Drop Hammer.
18"x12' Hendey Grd. Hd., T.A.
5' American Radial, Semi-Universal, B.D.
#2 Kempsmith Plain Miller, B.D.
39"x36"x12' Cin. Planer, 2 Heads
26" S. & M. B.G. Shaper B.D.
#59¼ Toledo Press 12" Stroke.
#14 Cochrane-Bly Vert. Miller & Shaper, M.D.
Bolt Cutters 1"x1⅛"-2"-3"-4" Acme.
WEST PENN MACHINERY COMPANY
1210 House Bldg. Pittsburgh, Pa.

POWER PRESSES

BLISS, TOLEDO, V & O, ETC.
REBUILT — GUARANTEED
JOSEPH HYMAN & SONS
Tioga, Livingston and Almond Streets
Philadelphia, Pa.

9" SPINDLE INGERSOLL MILLER

for Heavy Duty Facing Work available for immediate inspection under power and delivery in March



Following Machines in stock

Can be rebuilt and motorized to suit your requirements:

PLANERS

1—30"x30"x12'	Whitcomb,	2-heads, MD
1—36"x36"x12'	Betts,	4-heads, MD
1—36"x36"x16'	Niles,	4-heads, MD
2—42"x42"x12'	Cincinnati,	2-heads, MD
3—42"x42"x12'	Pond,	2-heads, MD
1—42"x42"x16'	NBP	3-heads, MD
1—47"x40"x12'	Gray,	2-heads, MD
1—48"x48"x16'	Putnam,	4-heads, MD
1—60"x60"x18'	Niles,	4-heads, MD
1—72"	Morton Portable	Draw Cut

MILLERS

1—9" Spindle Ingersoll Horiz. Facing Mill
1—37"x37"x14' Ingersoll Adj. Rail Slab Miller
1—#2V Potter & Johnson Vertical
3—28" Cincinnati Semi-Automatics
3—24" Cincinnati Automatic Facing Millers Hydraulic Feed

BORING MILLS

4" Betts Knee Table Type
4¾" Niles Knee Table Type
48" Niles Wheel Borer
7" & 5" Double Spindle Cyl. Borer

GRINDERS

1—20"x96" Landis Cyl. Motor Drive
1—24"x96" Landis Cyl. Motor Drive
1—30"x240" Landis Cyl. Motor Drive

GEAR CUTTERS

1—36" G&E Auto. Gear Cutter
1—60" G&E Auto. Gear Cutter
1—72" G&E Auto. Gear Cutter
2—Barber-Colman Single Overarm Hobbers

NEW MACHINES available for immediate delivery!

SURFACE GRINDERS	HAND MILLERS	12" SLOTTERS
Precision Type—6"x12"x18" capacity	Heavy Duty—High Speed	Dual Control—Motor in Base

ATLANTIC MACHINERY CORPORATION

149 BROADWAY Telephone WOrth 2-0662 **NEW YORK**

ReMANUFACTURED MACHINE TOOLS
-(ORIGINATED BY US)-

Reg. U. S. Patent Office

BORING MACHINES
No. 2—5" Bar Barrett

BORING MILLS
42" Gisholt

DRILLS
No. 1—1 Spdl. Leland-Gifford
1 Spdl. Henry & Wright
2 Spdl. Leland-Gifford Bench
2 Spdl. Henry & Wright
4 Spdl. Henry & Wright
4 Spdl. Sigourney
6 Spdl. Henry & Wright
No. 2—4 spdl. Colburn
No. 5-D—4 spdl. Moline Hole Hog
No. 17—2 Spdl. Foote-Burt Rail
No. 4—5 spdl. Foote-Burt Rail
No. 1 Baush Multiple
No. 3 Baush Multiple

RADIALS
5' Western Heavy
8' Western Heavy

GEAR CUTTERS
No. 12 Barber-Colman
No. ½ Pfauter Hobber
No. 1 Pfauter Hobber
No. 4—48" Brown & Sharpe
No. 5—48" Brown & Sharpe
No. 6—72" Brown & Sharpe
No. 6-A—72" Cincinnati
96" Newton Spur Gear
No. 6 Fellows
No. 61 Fellows
No. 62 Fellows
No. 36BM G&E Bevel Rougher

GRINDERS
(See page 118 special advertisement Hill-Clarke Cylindrical Grinders)
No. 40 Bryant Plain, Wide Wheel, Oscillating
No. 2½ Universal (Bath Type)
No. 5 Springfield Planer Type Surface
No. 2—18" Gardner Disc

LATHES
31½"x108" Fitchburg Lo-Swing
No. 4 AC Leblond Auto. Duplex Crankshaft
18"x6' Bradford Geared Head
20"—40"x10' Rahn-Larmon Geared Head Sliding Bed Gap
21"x8' LeBlond Universal
21"x10' LeBlond
24"x22' Lodge & Shipley, taper attachment
26"x10' Bridgeford
30"x12' Whitcomb-Blaisdell
50"x18' Schumacher & Boye

MILLERS
Model CS Becker Vertical Continuous Rotary
5" P&W Automatic
24"x24"x12' Ingersoll Adj. Rail
36"x36"x12' Newton Duplex
38"x44"x20' Ingersoll Slab
60"x57"x8' Beaman & Smith Duplex
No. 1 Smalley-General Thread

PLANERS & SHAPERS
24" Mark Flather, S.P.D. Shaper
24"x24"x6' Powell
24"x24"x6' Rockford
24"x24"x12' Gray
30"x30"x8' American
30"x30"x8' Powell
36"x36"x12' American
36"x36"x18' Cincinnati
42"x42"x14' Gray
48"x48"x10' Niles-Bement-Pond
48"x48"x12' Gray, Reversing M.D.

PRESSES
No. 303 Bliss Straight Sided
No. 58 Toledo Nosing
No. 42½ Pels Beam Shear

TURRET LATHES
21"x8' LeBlond Universal
2¼"x26" Greenlee, A.C. & B.F.
3¼"x40" Greenlee
3"x36" Jones & Lamson, 2 spdl.
3"x36" Pratt & Whitney, A.C. & B.F.
21" Gisholt, 3¾" H.S.
24" Steinle, 6¼" H.S.

MISCELLANEOUS
60" Quickwork Rotary Shear
No. 4 J. N. La Pointe Broach
6½" Avey Metal Band Saw
No. 12 Bignall & Keeler Pipe Machine

HILL-CLARKE MACHINERY COMPANY
651 Washington Blvd. Chicago

...IN STOCK

AUTOMATICS
No. 2G Brown & Sharpe
¾" Model F Gridley, four spindle
1¼" Model F Gridley, four spindle
1¾" Model F Gridley, four spindle
2¼" Model F Gridley, four spindle

BROACHES
No. 3 LaPointe

DRILLS
3' Cincinnati Bickford radial
No. 2 Colburn, single spindle
24" Barnes, power feed
No. 12 Natco Multiple Spindle
No. 13 Natco Multiple Spindle
Three Way Natco Horizontal Multiple Spindle

GEAR CUTTERS
No. 10 Lees-Bradner Gear Grinder
15" Gleason Spiral Bevel Generator
18" Gleason Gear Tester

GRINDERS
No. 70 Heald Internal
No. 55 Heald Internal
No. 60 Heald Internal
22"x84" Pratt & Whitney Surface
10"x20" Landis Cylindrical
18"x96" Brown & Sharpe Cylindrical
16"x50" Norton Crankshaft
20A Bellvue Drill
Ingersoll Cutter, Tub Type

LATHES
14"x6' Monarch, c.d.
16"x6' Lodge & Shipley, c.d.
16"x8' American, q.h.
18"x8' Monarch, c.d.
21"x8' LeBlond, c.d.
18/36"x12' Rahn Larmon Extension Bed Gap
No. 9 LeBlond Multicut
9" Sundstrand Manufacturing
3½x60" Fitchburg Lo-Swing, q.h.
8"x"60" Fitchburg Lo-Swing, q.h.
18"x7' Chard Production, c.d.

TURRET LATHES
No. 1B Foster
Model C 26" Libby 7½" hole
No. 2A Warner & Swasey
No. 1 Warner & Swasey
No. 4 Warner & Swasey
No. 7 Bardons & Oliver
No. 9 Bardons & Oliver
2¼x24 Jones & Lamson
No. 6A Potter & Johnston Automatic

MILLS, BORING
52" Gisholt vertical, m.d., power rapid traverse

MILLS, PLAIN
No. 4B Kearney & Trecker, double over-arm, spd.
No. 3B Kearney & Trecker, spd.
No. 3 Cincinnati, c.d.
No. 3 Cincinnati, s.p.d.
No. 14A Garvin, c.d.

MILLS, UNIVERSAL
No. 2 Cincinnati, s.p.d.
No. 2A Garvin, c.d.

MILLS, VERTICAL
No. AB Becker, c.d.
No. 4B Becker, c.d.

PLANERS
26"x26"x8' Gray
30"x30"x8' Cincinnati
33"x33"x10' Cincinnati
36"x36"x12" Woodward & Powell

SAWS
No. 4 Atkins Band, m.d.
No. 12 Higley Cold Cut
No. 6 Nutter & Barnes

SHAPERS
16" Hamilton, c.d.
20" Cincinnati, c.d.
24" Cincinnati, c.d.
24" Cincinnati, s.p.d.
28" American, s.p.d.

INDIANAPOLIS MACHINERY & SUPPLY CO., INC.
1959-69 South Meridian Street
INDIANAPOLIS, INDIANA
Eastern Branch:
44 WHITEHALL STREET, NEW YORK, N. Y.

MOREY
DEPENDABLE
USED MACHINES

Ingersoll 24"x24"x12' Slab Miller
P & W 6"x132" Thread Miller
McCabe 24"x42"x14' Double Spindle Lathe
McCabe 24"x48"x14' Double Spindle Lathe
Bridgeford 36"x40', 15 speed Geared Lathe
Sellers 42" Car Wheel Lathe
Foster No. 1F Fastermatic Turret Lathe
Natco No. 11 and No. 12 Multi Spindle Drills
Barnes No. 3 Horizontal Drill
Sipp 3 spindle High Speed Drill
B. & S. #4—48" Gear Cutter
Gould & Eberhardt 24"x8" Spur & Bevel Gear Cutter
Gleason 24" Bevel Gear Planer
Gleason 37" Bevel Gear Planer
Gleason 6"-11"-18" Bevel Gear Generators
La Pointe No. 2 and No. 4 Broaching Machines
Landis 3½" Internal Hydraulic Race Grinder
Heald Nos. 55-60-65 Internal Grinders
New Britain No. 22 Automatic Chucking Machine
Bliss No. 31 Geared Fly Wheel Press, M.D.
Bliss No. 5 Back Fly Wheel Press
Bliss No. 73½ Straight Side Press
Bliss No. 160 Single Stroke Crank Press.
Cleveland 1¼" Model "A" Automatic Screw Machines
Cleveland ⅝" Model B Automatic Screw Machine
Espen Lucas No. 138 Cold Saw—Cap. 12" Rd.
Newton No. 200 Cold Saw—Cap. 11" rd.
Cochrane & Bly No. 5 and No. 6 Cold Saws
Cleveland No. 1 Plate Planer—21' capacity
Frew Single Spindle Profiler
Woodward & Powell 30"x30"x8' Planer—single head
Acme 1" All Steel Upsetter
Ajax 3" All Steel Upsetter
Saunders 8"-18" Pipe Threader, M.D.

THIS IS A PARTIAL LIST

• *Write us* •
your Specific Inquiries

MOREY MACHINERY CO., Inc.
410 BROOME ST., NEW YORK

Our policy is to continue giving the best we have for our customers and to bend every effort for immediate delivery of War Defense machinery

AUTOMATICS

1" **Cleveland** Model J double end threading, pointing, turning or drilling.
2" **Cleveland** Model A.
Nos. 24, 33 & 34 New Britain chucking.
No. 6A Potter & Johnston.
14" **Fay** automatic.
No. 16 Gisholt Simplimatics.

AIR COMPRESSORS

136', 8"x8" **Chicago Pneumatic Tool Co.**, type NSB.
136', 6"x8" **Ingersoll-Rand**, type ER1.
355', 12"x10" **Ingersoll-Rand**, type ER1.
357', 12"x10" **Bury**, class HL.
550', **National** 3-cylinder vertical.
620', 14"x8¾"x10' **Sullivan**, class WJ3, angle compound, 2 stage, synchronous motor.
706', 17"x9¾"x12" **Sullivan**, class WJ3 angle.
868', 17"x10"x12" **Chicago Pneumatic Tool Co.**, type OCB, 2 stage.

BROACHES

No. 1 LaPointe, screw type.
No. 2 Standard screw type broaching press, 12" stroke.
No. 3 Oilgear hydraulic, motor drive.
Nos. 3 & 4 LaPointe of Hudson, screw type.
No. 3 J. N. LaPointe double screw type.
No. 3 American high speed, rack type.

DRILLS, RADIAL

3' **Cincinnati.**
4' **Hammond** sensitive, elbow arm, Tapper.
4' **American.**
3½', 5' & 7' **Western.**
6' **American**, 14" column.

GEAR MACHINERY

5A **Cincinnati** gear cutter.
No. 18H Gould & Eberhardt universal gear hobber.
12"x13" **No. 12H Gould & Eberhardt** Mfg. hobber.
12"x10" **No. 12 Barber Colman** hobbers.
24" **No. 3 Adams Farwell** gear hobber.
8"x10" **No. 1 Lees Bradner** production hobber.
14"x8" **No. 5A Lees Bradner** universal hobbers.
26"x8" **No. 3 Brown & Sharpe** auto. spur.
36"x6" **Gould & Eberhardt** spur gear cutter.
48"x10" **No. 4 Brown & Sharpe** automatic spur.
National Tool Co. (Cleveland) Model B gear and gear shaper cutter checking machine.
Lipe gear tooth chamfering machine, double spindle.

LATHES, ENGINE

All have quick change gears unless otherwise noted.
14"x6' **LeBlond.**
14"x 8' **Lodge & Shipley**, patent head.
14"x 8' & 16"x10' & 18"x8' **Monarch.**
16"x 6' **Cincinnati.**
16"x 8' **American.**
18"x 6' **Rahn Larmon.**
18"x 8' **Walcott.**
18"x 8' **American.**
19"x 8' **Sidney.**
20"x10' **American.**
20"x10' **Davis**, double back geared.
24"x10' **Schumacher & Boye**, D.B.G. & T.A.
24"x10' **LeBlond** heavy duty, D.B.G. & T.A.
24"x10½' **New Haven**, standard change gear.
24"x12' **Lodge & Shipley** patent head.
24"x14' **Schumacher Boye.**
24"x16' **Schumacher Boye**, D.B.G. & T.A.
36"-43"x18' **New Haven**, 23" bed extension.
36"-47½"x21'0" **Wickes** double back geared.

LATHES, TURRET

Most of these can be supplied either with bar feed and automatic chuck or arranged for chucking work.
No. 3A Warner & Swasey.
14" **Warner & Swasey.**
1½" (18" swing), **No. 3 Gisholt.**
1½" (17" swing), **No. 4 Foster**, power cross feed.
2¼"x26" **Acme.**
17½" swing **No. 4 Bardons & Oliver.**
18" swing **No. 4 Cincinnati Acme.**
21" **Gisholt.**
2¼"x24" **Jones & Lamson**, cross feeding headstock.
3"x36" (14½" swing) **Jones & Lamson**, cross feeding headstock.
24" **Steinle**, geared head.

LATHES, PRODUCTION

9"x14" **Porter** cable.
9"x24" **Sundstrand.**
13"x 4' **LeBlond** geared head.
13"x 6' **Automatic** threading lathes, geared head.
16"x 5' **Monarch** Mfg. or rapid production.
18"x10' **LeBlond** rapid production.
18"x 7'-6" **Wickes** geared head, rapid production.
20"x8' **Wickes** 12 speed selective geared head Rapid Prod.
34"x61½" **between spindles Wickes** semi-automatic center drive crankshaft.
Melling 4 cylinder camshaft lathe.
Melling 6 cylinder crankshaft lathe.

MILLS, VERTICAL BORING

34" **Colburn.**
36" **Niles** car wheel boring.
60" **Bullard**, 2 swivel heads, power rapid traverse, motor drive.
62" **Colburn**, 2 swivel heads, motor drive, power rapid traverse.

MILLING MACHINES

No. 2A Owen, universal.
No. 14A Garvin, plain. Range 28"x8"x19".
No. 34 Ohio (Oesterlein) plain. Range 34"x12"x19".
No. 3 Van Norman duplex.

MILLING MACHINES, VERTICAL

No. 6 Becker, 18"x61" table.
Model A B Becker, 10¾"x33¾" table.
No. 3 Becker, 10¼"x28" table.
Model C Becker, 29¾" rotary table.
Nos. 4 & 1½ Knight.
No. 5 Brown & Sharpe, 16"x52" table. Range 52"x12"x24". Has 20" dia. power feed rotary table.

MILLERS, PRODUCTION AND MISCELLANEOUS

Sundstrand Rigidmill with rotary table.
12" **Cincinnati** plain and BG Mfg. millers.
48" **Newton**, 2 spindle continuous rotary.
60" **Ingersoll**, 3 spindle, continuous rotary.
No. 45 Bilton Productomatic.
Nos. 3, 3B & 6 Lees Bradner thread miller.
No. 3½ Fox, hand.
No. 33 Kempsmith Mfg.
Nos. I & IA Davis & Thompson drum type continuous.

PLANERS

24"x24"x24" **Cincinnati**, crank type, one rail head.
24"x24"x 5' & 0' **Gray**, 1 rail head.
24"x24"x 6' **Woodward & Powell**, 1 rail head.
26"x26"x 8' **American**, 1 rail head.
30"x30"x10' **Cincinnati**, one (or two) rail heads.
32"x32"x12' **Niles**, 1 rail & 1 side head.
36"x36"x10' **Woodward & Powell.**
56"x56"x16' **Gray**, 2 rail and 2 side heads.

SHAPERS

7" **Rhodes.**
15" **American.**
16" **Walcott.**
20" **Smith & Mills.**
22" **Ohio.**
24" **Gould & Eberhardt.**
24" **Cincinnati.**
24" **Rockford.**
24"x24"x24" **Cincinnati** crank shaper planer.
32" & 36" **Morton** draw cut.

SHEET METAL AND WIRE MACHINERY

4'x3/16" **Cincinnati** press brake.
72"x14 ga. **Stamco** squaring, motor drive.
No. 1A Ajax taper forging roll.
Yoder fender roll.
⅛"x3' & 5' **Shuster** wire straightener and cutters.

Ask for complete List No. 173

MILES MACHINERY COMPANY - - - - Saginaw, Mich.

UNUSUAL VALUES

Shapers: 24" G&E.
28"x20'6" Rahn-Carpenter Lathe 14' between centers
24"x16' Greaves & Klusman
Briggs Type A Milling Machine, Long Table
#12 Brown & Sharpe Production Milling Machine
Presses: #43 Niagara, #16 J. M. Robinson ⅞" capacity Rock River punch and shear
Broaching Machines, LaPointe #1, #3.
Drill Presses: 28", 24" Hoefer; 25", 20", 40" Bement
2 50# Bradley upright hammers, m.d. like new
Radial Drills: 5' Bausch
Miller: 20"x24"x18" Ingersoll
Grinders: #20 Bryant Internal
300 other machinery items
MOTORS—new 5 H.P. for 3-phase, ball brg. $55.75

Other sizes equally low priced. Also rebuilt motors.

THE OSBORNE & SEXTON MACHINERY CO.
COLUMBUS, OHIO

EXCEPTIONAL TOOLS

LATHES

30"x20' LeBlond, q.c. mtrzd.
18"x16' Flather, belt drive, quick change.
40 Lathes in stock, 12" to 54" swing

GRINDERS

12"x36" Pratt & Whitney Surface belt drive.
12"x36" Modern Plain Cylindrical, self contained.
20"x144" Landis Plain Cylindrical.

POWER PRESSES

#4 Federal Inclinable, 3" stroke, bed 27"x14¾", cap. 35 ton.
25 ton Henry & Wright h.s. Dicing Machine, 5½" single roll feed.

MISCELLANEOUS

20 spindle Natco, mtr. dr. #2 M.T.
#2 Baker Keyseater, belt dr. cap. 2"x20".

THE O'BRIEN MACHINERY CO.
113 N. THIRD ST., PHILA., PA.

HIGH GRADE MACHINE TOOLS

LATHES

14"x6' Hendey Grd. Hd. S.P.D. T.A.
16"x8' South Bend Cone Drive, Q.C.
20"x8' American High Duty Cone, Q.C.
18"x8' LeBlond Cone, B.G.
18"x8' Greaves Klusman Grd. Hd. T.A. Q.C.
20"x17' Greaves Klusman Grd. Hd. T.A. Q.C.
20"x8' American Grd. Hd. M.D.
25"x16' LeBlond H.D. 3 S.C.D. D.B.G.
36"x20' Fifield Engine Lathe, Cone Drive.

GRINDERS

#55 Heald Internal Grinder, Belt driven.
12" Pratt & Whitney Surface Grinder, B.D.
14"x72" Queen City Self Contained Plain.
60"x60"x12' Pond H.D. 4 hds.
#5 Oliver Drill Grinder, Motor Driven.

GEAR CUTTERS

#3-26" B & S Gear Cutter.
#1 and 3 Adams Gear Hobbers.

BORING MILLS

42" Niles Bement Pond, H.D.

BOLT & PIPE THREADERS

2' Landis with Lead Screw Cone drive.
3" Landis Cone drive.
1" Acme Cone drive.
2" Landis Pipe Machine Cone drive.
2" Acme Cone drive.

RADIAL & UPRIGHT DRILLS

4'x6' Bickford Plain S.P.D.
20" Barnes 4 spindle drill.
26" Barnes All geared Tapping attachment.

SHAPERS & PLANERS

24" Rockford H.D. Back Geared Crank.
24" Steptoe H.D. Back Geared Crank.

CINCINNATI MACHINERY & SUPPLY CO.
217 East Second St. Cincinnati, Ohio

MISCELLANEOUS MACHINES

Rockford Dbl. End Hydraulic **Boring Machine**
24"x14' bed Schumacher-Boye Lathe, rebuilt
2" Landis Dbl. Spdl. **Bolt Cutter**
3" Landis Single Spdl. **Bolt Cutter**
30x30x8' **Gray Planer**, 2 hds.
#40 NATCO Straight Line **Multiple Drill**
#60 NATCO 3-way **Multiple Drill**
4' **Hammond Radial**, m.d.
Rockford Sgl. End. **Hydraulic Boring Unit**, with 2-sta. 54" dia. table
C-13H **NATCO Hydraulic**, m.d.
30" **Diamond Face Grinder**, m.d.
Bryant Internal Grinder with c/s
#14-26" **Besley Disc Grinder**, b.d.

THE STRONG, CARLISLE & HAMMOND CO.
1392 West 3rd St., Cleveland, Ohio — 2832 E. Grand Blvd., Detroit, Mich.

No. 3 Acme Universal Turret Lathe. Grd Head. Arranged for Chucking.
21" Model H Gisholt Turret Lathe.
14 ga x 8' OHL power Squaring Shear.
4 & 6 Spindle Avery Sensitive Drills No. 2 M.T., B.B.
No. 1B, No. 2B Edlund, 2 Spindle Sensitive Drills
16"x66" Landis Universal Grinder. Overhead belt drive
24"x24" Ohio Planer, 1 head, belted moto. drive.
18"x9' Chard Lathe semi quick change cone.
10' Robinson Toggle Type Press Brake
No. 12, 13 Natco Drills

IROQUOIS MACHINERY CO.
662 Ohio St. Buffalo, N. Y.

FOR SALE
FORGING & UPSETTING MACHINE
3⅛" Acme driven by 20 H.P. motor
IRON & STEEL PRODUCTS, INC.
37 years' experience
13498 So. Brainard Ave., Chicago, Ill.
"*Anything* containing IRON or STEEL"

GEAR CUTTERS, Spur, 30", 40" & 84", M.D.
GEAR PLANERS, Bevel, 36" & 54" Gleason, M.D.
GRINDER, Gear Tooth D-12 Detroit, M.D.
GRINDER, Warm Hob 10" x 12", B.D.
GRINDER, Universal, No. 5 B & S, 20"x72", B.D.
LATHE, Geared Head, 27"x11' LeBlond Hvy. Duty
LATHE, Wheel, 72" Bement-Miles, M.D.

LANG MACHINERY COMPANY
28th Street & A.V.R.R. Pittsburgh, Pa.

36" G & E Gear Cutter, M. D.
No. 73½ Bliss S. S. geared Press
No. 7 Oxygraph Gas Cutting Machine
5—Watson-Stillman 200-Ton Molding Presses

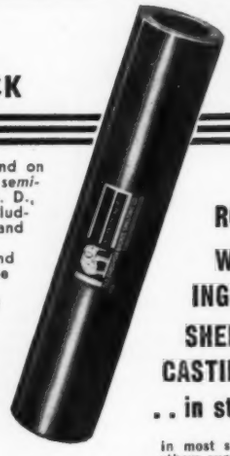
D. E. DONY MACHINERY CO.
New and Used Machine Tools
47 Laurelton Road Rochester, N. Y.

Save machine time, man hours

with

ELEPHANT BRAND PHOSPHOR BRONZE

12 inch . . .
Semi-finished
BAR BUSHING STOCK



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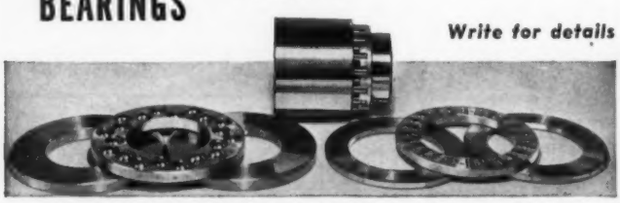

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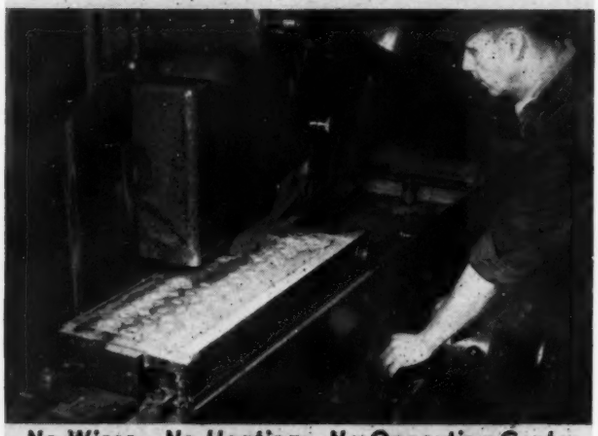

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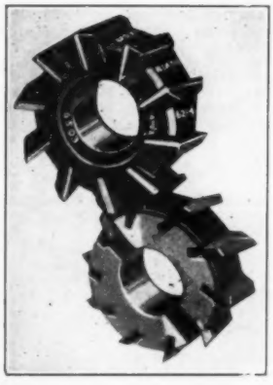

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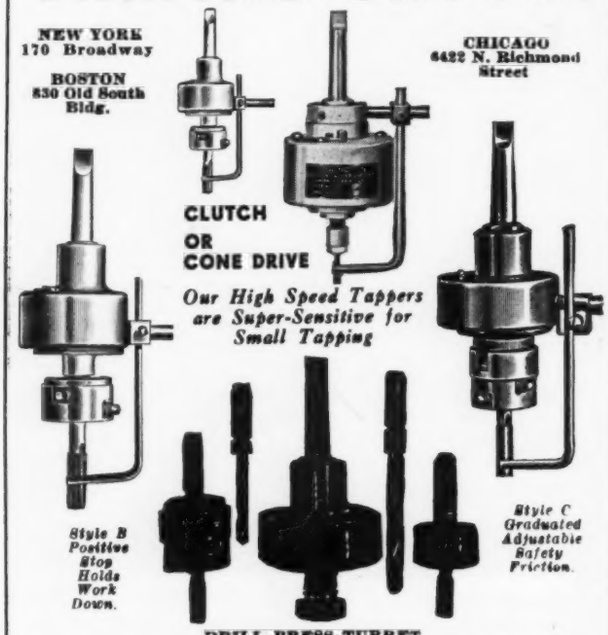
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Danly Mach. Spec. Co., Inc., Chicago, Ill.

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Errington Mech. Laboratories, Staten Island, N. Y.
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Landis Mach. Co., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.

DIES AND TOOLS
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Morse Twist Drill & Machine Co., New Bedford, Mass.

DIESEL FUEL INJECTION PUMPS
Excello Corp., Detroit, Mich.

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Scherr Co., George, New York, N. Y.

DOGS, Lathe and Milling Machine
Armstrong Bros. Tool Co., Chicago, Ill.
Ready Tool Co., Bridgeport, Conn.

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Carboloy Co., Detroit, Mich.
Crafts Co., Inc., Arthur A., Boston, Mass.
Desmond-Stephan Mfg. Co., Urbana, Ohio.
Norton Co., Worcester, Mass.
Victor Machinery Exchange, New York, N. Y.

DRILL HEADS
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DRILLING & TAPPING HEADS, Multiple
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Production Machine Co., Greenfield, Mass.

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Cincinnati Bickford Tool Co., Cincinnati, Ohio.
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Kingsbury Mach. Tool Corp., Keene, N. H.

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Fosdick Machine Tool Co., Cincinnati, Ohio.
Grant Mfg. & Mach. Co., Bridgeport, Conn.
Kingsbury Mach. Tool Corp., Keene, N. H.

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Morse Twist Drill & Machine Co., New Bedford, Mass.
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Carboloy Co., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.

DRILLS, Ratchet
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Morse Twist Drill & Machine Co., New Bedford, Mass.
Union Twist Drill Co., Athol, Mass.

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Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Union Twist Drill Co., Athol, Mass.

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Surface Combustion Corp., Toledo, Ohio.

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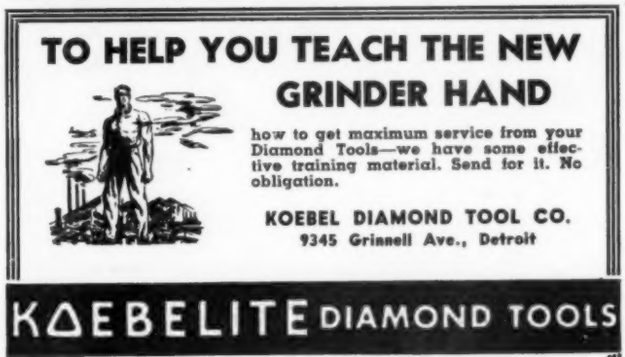
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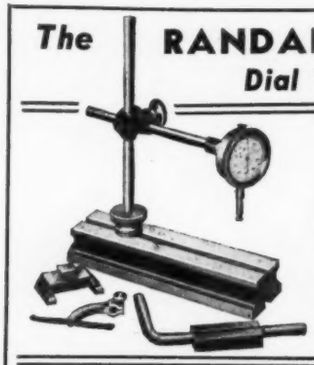

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Wilson Brothers, Cashmere, Wash.

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Perkins Mach. & Gear Co., Springfield, Mass.
Philadelphia Gear Works, Philadelphia, Pa.

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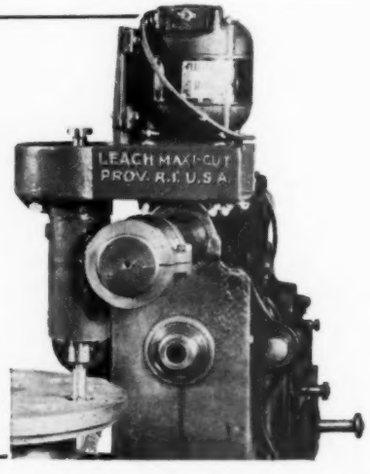

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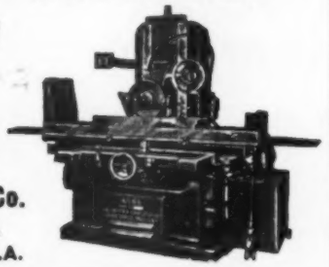

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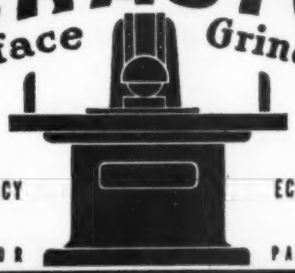

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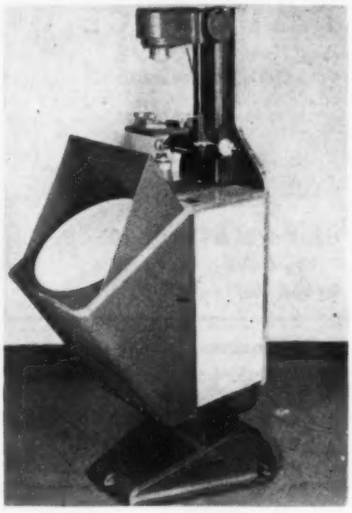

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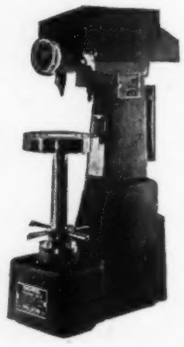

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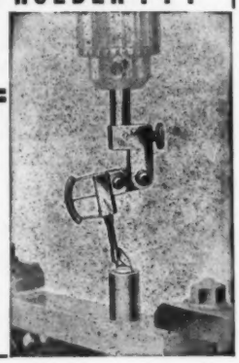

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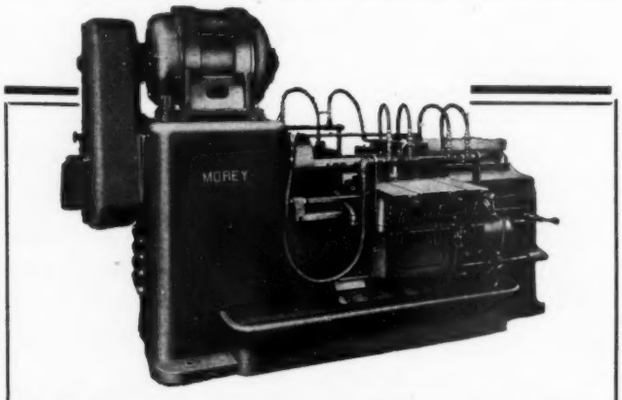

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LATHES, Shell
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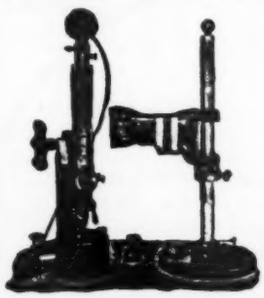

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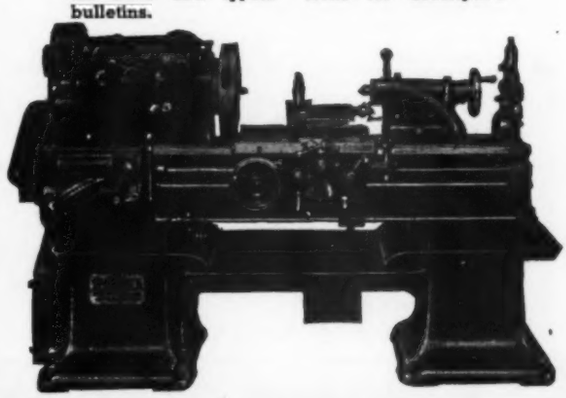

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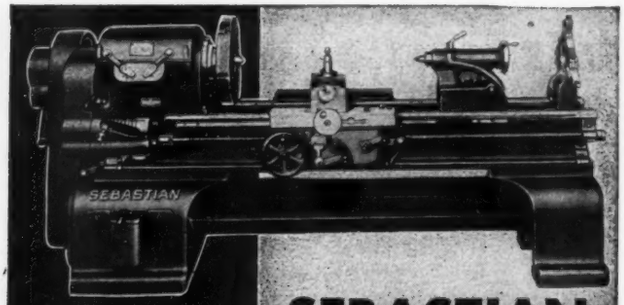

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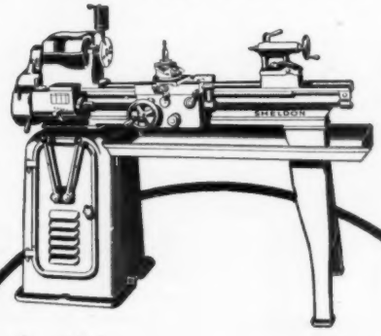

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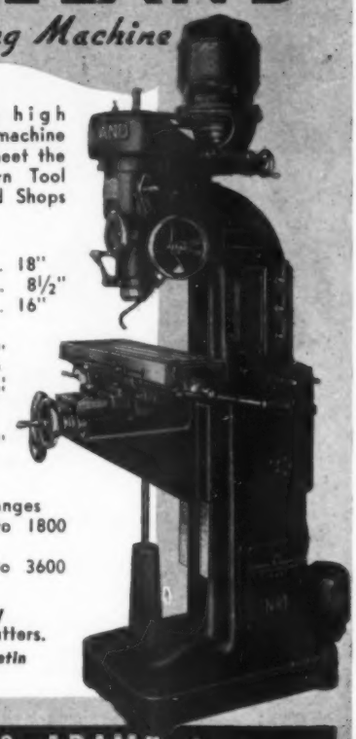
CLEVELAND
Vertical Milling Machine



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Longitudinal Feed ..... 18"
Cross Travel ..... 8½"
Vertical Travel ..... 16"

Table
Working Surface—8"x32"
T-Slots — three 17/32", center to center 1⅞"

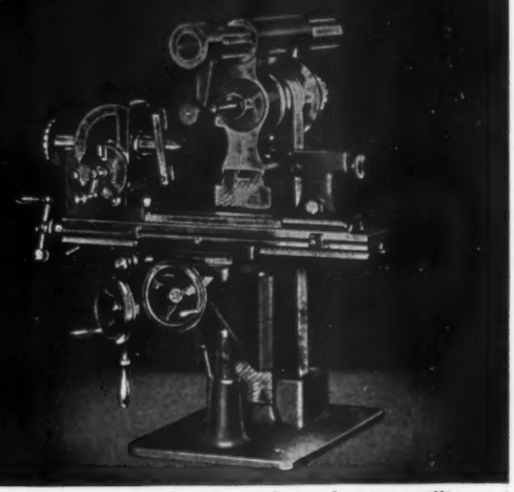
Table Feeds
Twelve ranging from .6" to 12½" per min.
Motor ⅓ H.P.
Spindle Speeds—Two Ranges
12 speeds 100 r.p.m. to 1800 r.p.m.
12 speeds 200 r.p.m. to 3600 r.p.m.

Cutter Capacity
1/16" to 2½" milling cutters.

Full descriptive bulletin upon request.

The SOMMER & ADAMS Company
CLEVELAND · · · OHIO, U.S.A.

AMES Precision
BENCH MILLING MACHINE



For most accurate toolroom and production milling. Large in size and capacity. Cutter head and indexing head take same 1" capacity collet. Separate headstock for vertical milling. Motor and jackshaft drive.

B. C. AMES CO., WALTHAM, MASS.

Speedier deliveries now, because of Ruthman's enlarged manufacturing facilities.

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COOLANT PUMPS

Model P3

P3 is available in external right or left discharge models, flange-mounted and immersed models.

Simple in construction—no packing nuts—no foot or relief valves. Built-in motor, sturdy vertical shaft on ball bearings, double suction intake giving balanced impeller . . . these and other famous time-saving Gusher features help *SPEED* your jobs.

There's a Gusher model to fit your needs. Write for information.

THE RUTHMAN MACHINERY CO.
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LARGEST EXCLUSIVE BUILDERS OF COOLANT PUMPS

LIBERTY HEAVY DUTY PLANERS

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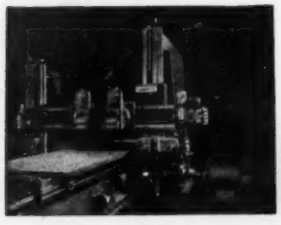

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.... triple reduction all steel gear train with herringbone high speed drive and double balanced intermediate drive
.... Universal side heads with power and hand feed vertically and horizontally
.... rapid traverse in all directions
.... push button controlled reversing motor drive
.... electric clamping of cross rails
.... friction type electric feed.

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Durable—Liquid tight—5 gallon capacity—pressed from 1/16" sheet steel—21½x13¾"x5¾" inside.

Write for low prices today.

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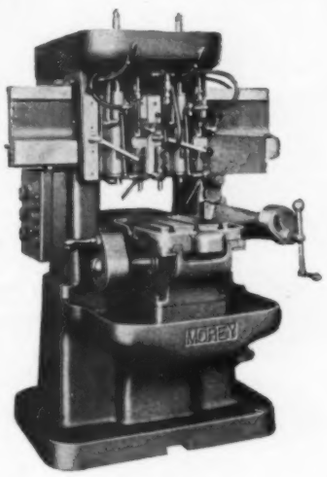

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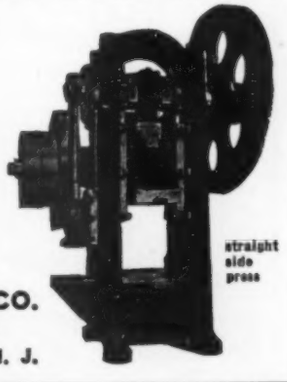

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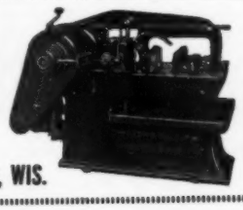

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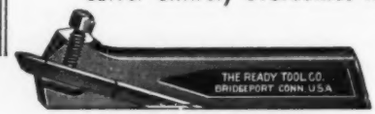

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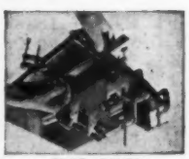

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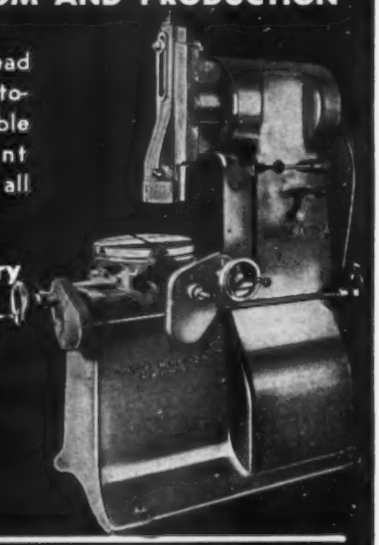
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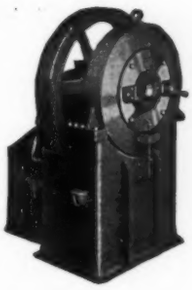
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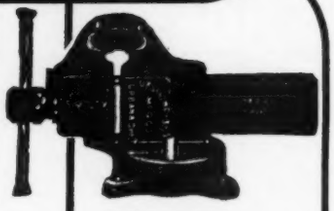

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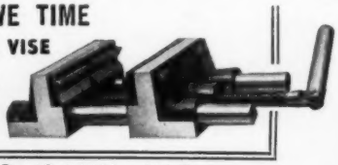

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Warner & Swasey Co., Cleveland, Ohio

TURBINES, Steam
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

TURRETS, Tool Post & Tail Stock
American Tool Works Co., Cincinnati, Ohio
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vt.
Warner & Swasey Co., Cleveland, Ohio

UNIT HEATERS, Gas Fired
Surface Combustion Corp., Toledo, Ohio.

USED MACHINERY (See Searchlight Section)
Aaron Machinery Co., New York City
Advance Machry. Exchange, N. Y. C.
Atlantic Machinery Corp., New York, N. Y.
Central Mach. Tool Corp., Toledo, O.
Cincinnati Machy. & Supply Co., Cincinnati, Ohio
Dony Mchry. Co., D. E., Rochester, N. Y.
Dulien Steel Prod., Inc., Fresno, Calif.
Eastern Mchy. Co., Cincinnati, Ohio
Emerman & Co., Louis E., Chicago, Ill.
Falk Machinery Co., Rochester, N. Y.
Hill Clarke Machinery Co., Chicago, Ill.
Hyman & Sons, Jos., Phila., Pa.
Indianapolis Mchy. & Supply Co., Indianapolis, Ind.
Iron & Steel Products, Inc., Chicago.
Iroquois Mchy. Co., Buffalo, N. Y.
Lang Machry. Co., Pittsburgh, Pa.
McDonald Machinery Co., St. Louis.
Miles Mchy. Co., Saginaw, Mich.
Morey & Co., Inc., New York, N. Y.
Nuttall, J., Philadelphia
O'Brien Mchy. Co., Philadelphia, Pa.
Osborne & Sexton Mchy. Co., Columbus, Ohio
Ott Mchy. Sales Co., Detroit, Mich.
Reconstruction Machine Tool Corp., N. Y. C.
S. & S. Machinery Co., N. Y. C.
Simmons Mach. Tool Corp., Albany, N. Y.
Strong, Carlisle & Hammond Co., Cleveland, Ohio
West Penn Machry. Co., Pittsburgh, Pa.
Wigglesworth Machry Co., Cambridge, Mass.
Zeeve & Co., Alex, New York, N. Y.

UNIVERSAL JOINTS
Gray & Prior Machine Co., Hartford, Conn.

V BELTS
Allis Chalmers Mfg. Co., Milwaukee, Wis.

VALVES
Hydraulic Press Mfg. Co., Mt. Gilead, Ohio.

VALVES, Air Control
Nicholson & Co., W. H., Wilkes-Barre, Pa.

VERNIERS
Brown & Sharpe Mfg. Co., Providence, R. I.

VISE STANDS
New Britain-Gridley Machine Co., New Britain, Conn.

VISES, Drilling Machine
Armstrong-Blum Mfg. Co., Chicago, Ill.
Fenn Mfg. Co., Hartford, Conn.
Hartford Special Mchy. Co., Hartford, Conn.
Johnson Tool Co., East Providence, R. I.
Sheldon Machine Co., Chicago.

VISES, Machine
Armstrong-Blum Mfg. Co., Chicago, Ill.
Fenn Mfg. Co., Hartford, Conn.

VISES, Machinist
Desmond-Stephan Mfg. Co., Urbana, Ohio
Wiedemann Machine Co., Phila., Pa.

VISES, Milling Machines
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., The, Cincinnati, Ohio
Fenn Mfg. Co., Hartford, Conn.
Hartford Special Mchy. Co., Hartford, Conn.
Kearney & Trecker Corp., Milwaukee, Wis.
Sheldon Machine Co., Chicago.

VISES, Pipe
Armstrong Bros. Tool Co., Chicago, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.

VISES, Universal
Mohr Lino Saw Co., Chicago, Ill.

WASHING MACHINES, Metal
Alvey-Ferguson Co., 71 Disney St., Cincinnati
Barrett Co., Leon J., Worcester, Mass.

WELDED EQUIPMENT
Bayard & Co., M. L., Philadelphia, Pa.

WELDERS, Arc
Hobart Brothers, Troy, Ohio

WELDING, Automatic
Una Welding, Inc., Cleveland, Ohio

WELDING ELECTRODES
General Electric Co., Schenectady, N. Y.

WELDING MACHINES, Electric
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

WELDING RODS
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WIRE & CABLE, Insulated
General Electric Co., Schenectady, N. Y.

WORM DRIVES
Gear Specialties, Inc., Chicago, Ill.
Perkins Mach. & Gear Co., Springfield, Mass.
Philadelphia Gear Works, Philadelphia, Pa.

WORMS
Gear Specialties, Inc., Chicago, Ill.

WRENCHES, Machinist
Armstrong Bros. Tool Co., Chicago, Ill.

WRENCHES, Pipe
Armstrong Bros. Tool Co., Chicago, Ill.

WRENCHES, Ratchet
Greene, Tweed & Co., New York, N. Y.

WRENCHES, Socket
Armstrong Bros. Tool Co., Chicago, Ill.

WRENCHES, Tap
Card Mfg. Co., S. W., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.

"Simplified" Arc Welders
The Fastest Selling Arc Welder the Market Today
free!
WRITE TODAY FOR THIS VALUABLE BOOK
HOBART
One of the World's Largest Builders of Arc Welders
BROTHERS CO., BOX AM-22 TROY, OHIO

Chips

Cold Anger . . . Reported the New York *Sun* Dec. 24, "Since the attack on Pearl Harbor, production in a West Coast aircraft plant has increased 25 per cent without any increase in facilities for production—except cold anger." That selfsame cold anger seems to us to be the one best antidote for the fabled Jap fanaticism. A fanatic is a madman, capable of bombing open cities, and successful for a time. But cold anger makes the reasoning individual a superman—and over the long pull.

That "Long Pull" Is Coming . . . Other plants in all divisions of Metal-Working report similarly increased production based on cold anger. Machine-tool builders report decided step-ups in working pace. One aircraft plant manager informed workers that the plant would be open Christmas Day for anyone who wanted to come to work. Over 70% of the force was working, because "until we beat the Axis, Christmas is just another day." Add to that feeling our indignation over the ruthless bombing of open Manila, and America will soon win the Battle of Production.

Liberty or — . . . *The Saturday Evening Post* for Jan. 10 does us the honor of quoting from our Machine-Tool Production Number (Nov. 26, '41) in its fighting editorial. The quote: "This war is a battle of production. The side which produces the greater number of planes, guns, tanks and shells will win." The President's talk of Jan. 6 made that statement startling clear to the whole nation.

Up 24 Times . . . Add to current statistics the fact that contracts for new metal-working plants and additions have increased 24 times in two years, according to *Engineering News-Record*. The 1939 figures were $38,761,000, the 1940 were

$315,000,000, and the 1941 were $950,000,000. This capacity will help us "Remember Pearl Harbor" with a vengeance!

Right-Angle Head . . . The regular Gleason ad in *American Machinist* last Feb. 5 was titled "17,000 R.P.M. Smoothly and Quietly . . . with Spiral Bevel Gears in the Flexible-Shaft Grinder". Illustrated was a very tricky right-angle head unit. December 23 came a wire from Morris Messick of Sheffield Corp. requesting the name of the maker of the unit. We wired J. R. Walgren of Gleason. He wired Mr. Messick that Haskins Co. of Chicago was the maker. We mention the circumstance here because it shows again the long life of advertising in *American Machinist*—for testifier as well as testified-to.

Batt at Bat . . . Among comments on the *Machine Tool Production Number* of Nov. 26 was this succinct statement from W. L. Batt, then Director of Materials, O.P.M. (now head, Materials Div., War Production Board), "You have done a good job of putting some very vital facts before the public." and from Brig.-Gen. N. F. Ramsey, commanding Rock Island Arsenal, "It was a most interesting number, and since the events of last Sunday (letter written Dec. 10), it has greatly increased importance." Again, from Lt. Col. A. R. Baird of the Los Angeles Ordnance Region, "The subject matter is most timely and informative."

Payrolls . . . U. S. Dept. of Labor payroll indices for the machinery and transportation divisions of Metal-Working show a rise from 62 in January, 1933, to 536 in October, 1941, or almost 9 times. Over half of the gain has occurred in the last year. Other evidences of burgeoning Metal-Working are our own subscriber stencils,

28% of which required changes in name, title or address in 1941. This is of course exclusive of new subscribers and expirations. Comparative changes in 1940 were 23% — up considerably from previous years.

Aircraft . . . Aircraft plants employ 6 times as many workers as in 1939, have 7 times as much dollar volume of production, are producing 4½ times as many planes. Current production rates are 2½ times those of a year ago. Estimates are for increases of 50% on top of all this.

2 Out of 3 . . . The Dec. 23 issue of "Victory" (Office of Emergency Management publication) shows at least 68¢ of every defense dollar spent for Metal-Working items. This covers $71 billion dollars worth of defense spending, so Metal-Working must produce something like 50 billion dollars worth of armament on present contracts. All-1939 production was only 19 billion. Of the total defense dollar, 23¢ goes for ordnance, 17¢ for planes, 13¢ for ships, 5¢ for other munitions.

For 65 of 67 . . . Just received is the renewal subscription of H. Osswald, vice-president and the "O" of the V&O Press Co., Hudson, N. Y. His original subscription was received in 1879, so he has been a reader for 65 of our 67 years.
This subdivision of Metal-Working will soon pass automobiles in production volume.—E.J.T.

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DEFENSE COMES FIRST

BECAUSE the superior speed, accuracy, and dependability of New Britain Automatics have, for years, been a mainstay of industrial production, everything we can contribute is needed now to strengthen this life blood of defense. Our increasing productive capacity has been devoted to defense for many months. Defense comes, not first, but all the time.

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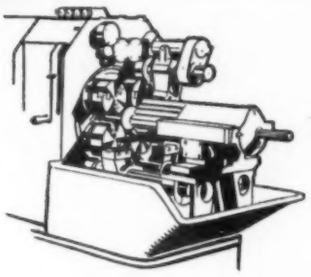

OPEN END CONSTRUCTION
providing *wide open* accessibility to all tools and convenient removal of chips, a typical feature which enables New Britain Chuckers to simplify, and thus speed Defense production.

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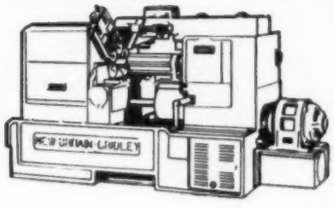
STAY ON THE JOB



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New Britain manufactures a complete line of Screw Machines . . . Four and Six Spindles up to 2¼" Capacity. Also a complete line of Chuckers . . . Four, Six and Eight Spindles up to 10¼" Capacity.

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The war must go on until the United States and her allies have achieved complete and final victory. After that —perhaps a resumption of commercial competition on a scale never before known.

What can you do *now* to help yourself *then?* You can make sure that your machines are equal to any probable future demands in speed, precision and economy.

If you manufacture machine tools, redesign them to get in more Timken Bearings. If you are a machine shop operator insist on your new machines being completely Timken Bearing Equipped to increase production; prevent waste; reduce costs.

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

Semi cast steel compressor heads are being ground on this No. 11 Blanchard Surface Grinder to a flatness of *seven millionths of an inch.* The finish measures 6 micro inches. The heads are 7" in diameter and ¾" thick. .005" of stock is ground off one surface. Production averages 40 parts per hour. Photograph courtesy The Blanchard Machine Company, Cambridge, Mass.